ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

Vol. LXV, No. 16. CHICAGO, SATURDAY, OCTOBER 17, 1914. ISSUED WEEKLY.

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY, INC.

608 SOUTH DEARBORN STREET

CHICAGO

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SUBSCRIPTIONS.

One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back one month, each.. .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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SPECIALIZATION IN THE ELECTRICAL CONTRACTING BUSINESS.

The tendency of this age is towards specialization along intensive lines of endeavor. This is partly due to the keen competition existing in most professions, businesses and trades and to the broadness of scope in all these fields. As a result many have realized that greater success could be obtained along their chosen lines of work, if they prepared themselves to be unusually proficient in certain particular phases, thus obtaining a reputation for ability along those lines that would give them added prestige. But specialization in one or more lines of work does not necessarily involve narrowness, for one need not confine his activities to those lines but merely seek to make the greater part of his work lie in the chosen field.

In the electrical contracting business competition is often exceedingly keen. The small contractor under such conditions has a very hard road to travel if he hopes to be among the important men in his business. Instead of inviting contracts in all branches of electrical contracting, contractors—even those with considerable business—may well consider the advisability of specializing in one class of contracting work.

In a small town specialization is often impossible because of the small amount of available business, but in larger towns the electrical contractor may take his choice of a number of lines of specialization, among which are residence wiring, old-building wiring, underground construction, factory and other power wiring, office-building wiring, farm-house wiring in the neighboring territory, switchboard construction, etc.

After a contractor has succeeded in obtaining a number of contracts in the field in which he intends to specialize or in a field in which he thinks it well to specialize, he will obtain a prestige in that line of work which, if he uses proper advertising methods, will prove of great value as a means for obtaining much work of similar nature. Moreover, because of the great amount of such work handled, the office details will be simplified, the wiremen will become specialists in that line of construction, knowledge of how to overcome common difficulties in such construction will be obtained and in general the whole organization will be more efficient than if efforts were made to obtain contracts regardless of their nature.

The more contracts one obtains in a particular field, the more efficient and proficient he and his whole organization will become in that field, with the result that the cost of such work will be reduced, thus permitting the firm to make lower bids, which will render the securing of work in that line easier. By specializing in one or more fields at the start a contractor just entering the business will stand more chance of success in his work than if he sought work of more varied nature. This is true of contractors doing a small business, although, of course, much depends upon the amount of business available. Under the same conditions a specialist in a certain branch of electrical construction has a much better chance of obtaining contracts in that field and making a good profit than the contractor who has only had a limited experience in that class of work.

PRODUCTION COSTS DECREASING IN MEDIUM-SIZED PLANTS.

One advantageous accompaniment of the increasing popularity of electrical service is the downward trend of station operating costs. There are many causes of the gains in plant efficiency which are being realized, even in installations of moderate size, but probably the widespread adoption of the steam turbine and the annual increase in total output at the busbars are the chief factors. Only three years or so ago a steam plant of from 5,000 to 10,000 kilowatt rating, which generated electricity at 9 to 10 mils per kilowatt-hour, exclusive of fixed charges, with coal costing about $4 per ton, was doing extremely well, whereas today a well designed station within this range of sizes gets down pretty close to 6 or 7 mils if it serves a community with a large absorbing capacity for electric lighting and power.

Figures just received from a 10,000-kilowatt plant operating in a large textile center illustrate this admirable gain. In the year closing June 30 last the plant generated 13,578,430 kilowatt-hours; the coal consumption, burning bituminous fuel at $4 per ton, was 14,989 tons; and the total station expense was $93,169, or 0.69 cent per kilowatt-hour. A detailed expense sheet shows that the wages cost was $18,297, or 0.135 cent per kilowatt-hour, while the fuel cost was 0.44 cent, and the fuel economy of the plant, including auxiliaries, was 2.47 pounds per kilowatt-hour. Station and equipment repairs came to about half the labor item. The maximum load carried by the plant during the year was 4,750 kilowatts and the yearly load-factor was 32.5 per cent. Of the total energy sales of 10,883,554 kilowatt-hours, 6,707,016 kilowatt-hours were sold to electric motor users, which of course played an important part in establishing the above load-factor.

Perhaps the most interesting point to be brought out is that another station of 11,000 kilowatts capacity in the same state, with a coal cost of $4.18 per ton and a total busbar output of 30,031,100 kilowatt-hours, made exactly the same record. In the first plant there are eight 350-horsepower water-tube boilers run at 160 pounds; in the second there are also eight boilers with a combined rating of 5,000 horsepower and a service steam pressure of 200 pounds. The former has two 1,000-kilowatt and two 4,000-kilowatt turbo units; the latter, one 5,000-kilowatt and three 2,000-kilowatt machines. In each station approximately half the output was consumed by power customers, but the second plant had a load-factor of 40.3 per cent for the year, the maximum load being 8,500 kilowatts, and the fuel consumption per kilowatt-hour, 2.51 pounds. Now both of these stations are under progressive managements, but the second is somewhat handicapped by being obliged to maintain a substation in a factory district at the opposite end of the town from the generating plant, which increases the labor cost by perhaps a half mil per kilowatt-hour, this apparently not being taken out of the main station record. A half mil is not a large matter, but in going into the lower ranges of power cost, from 6 or 7 mils downward to the 3 and 4-mil production figures reached by very large installations with high-powered turbines, say of 15,000-kilowatt capacity upward, every fraction of a cent lopped off the record comes hard. It is like the cost of the extra knot of speed in a submarine above its normal rating.

It would seem from these figures and personal knowledge of the two stations that the plant with the larger output ought to have shown better economy and it is safe to say that an investigation of the labor distribution, particularly on the electrical end of the installation, might result in desirable gains. The cost of distributing energy from more than one center in a city of less than 175,000 people is not always favorable from the standpoint of attendance and should be very carefully balanced against the cost of distribution from the main plant, where such possibilities arise.

However, turning aside from the problem of comparisons, the figures above show a typical reduction in the cost of manufacture which is most gratifying when contrasted with results obtained in the reciprocating-engine plants which these turbine installations superseded. The issue now is to learn how to make the most out of the new facilities, and even the superficial student of power economies cannot help seeing that continual gains are being made. With the annual outputs of tens and scores of millions of kilowatt-hours coming to be produced by plants serving active markets, still further improvements in efficiency are to be expected.

ACTIVE TIMES FOR RADIO OPERATORS.

In the flood of printed matter which overflows the daily press in connection with the European war one may now and then catch a hint of the part radiotelegraphy is playing in the great struggle, but few persons realize the strain under which the operators at important stations, and particularly on shipboard, are working in these historic days—and nights. An interesting and appreciative account of the duties of a radio operator on a battleship or cruiser which appeared a few days ago in an eastern daily pointed out the neces-

sity for secrecy which obtains during hostilities and touched upon the precautions necessary to guard against light or sound being sent forth into the darkness across the waters. Padded operating cabins and automatic switches on their doors which cut off the lights at the sending and receiving apparatus the moment the door is opened are incidentals of the work, which requires constant reading of messages from scouting vessels, shore stations, and the flagship, to say nothing of the transmission of orders and information. All of this must be carried on with self-control in face of imminent danger from mines, submarines, surface or aerial attack, and in the hidden but immensely important tasks of the wireless service the operators on scores of vessels are fulfilling the traditions of quiet heroism which are the pride of all electrical men who appreciate what it means to be prepared for and to meet emergencies.

In connection with the work of the wireless operator, it is interesting to note the effect of the wireless on the lines of battle and the actions of the vessels of war. The fleet steamers of each of the belligerents. now converted into fast cruisers for preying upon the commerce of each other have had their effectiveness greatly decreased by the watchful wireless revealing their whereabouts.

DESIGNING PLANTS FOR THE FUTURE.

The growth of central-station service has resulted in many interesting developments in plant design and as the economical radius of distribution from single installations has increased, some important problems of an engineering character have come to the front. Although the construction of new plants is not for the moment a pressing issue in many parts of the country, an era of further extensive development is bound to come in the future, particularly in sections where the growth of the local communities imposes heavy burdens upon small existing plants and in localities where the electrical needs of extensive regions are to be provided for.

An example of the difficulties which the absence of a broad foresight sometimes tends to create is afforded by the case of two neighboring stations controlled by the same interests, serving two adjacent communities, connected by a tie line, but peculiarly situated with respect to loads and the possibility of economical expansion. At the time these plants were built, the owners could not be blamed for failing to foresee the present situation, which is worth discussing, however, as a hint of matters to anticipate in future development work elsewhere. The larger plant, of 3,500 kilowatt rating, is situated without rail or tidewater connection in the center of a city of over 100,000 inhabitants; the coal supply, about 35 tons per day, is hauled by motor truck from a tidewater coal depot a mile distant; and the supply of condensing water is inadequate, a portion of this having to be purchased from the city mains at a cost of $1.30 per thousand cubic feet. This deficient water supply, even when aided by a well designed cooling tower, makes 24 inches the average daily vacuum and on the peak load only a few inches of vacuum can be obtained. The ground area of the plant does not admit of coal storage and is of insufficient size to permit enlargement of the station, even with the inherent compactness of turbine equipment in mind. The details of the equipment need not be elaborated, except to point out that there are five water-tube boilers, two 750-kilowatt engine-driven generators, one 400-kilowatt engine-driven generator and a 1,500-kilowatt turbo-unit, the condensing apparatus being of the jet type, with reciprocating pumps on the engine sets, and rotary pumps on the turbo-unit.

The other plant, rated at 1,650 kilowatts, is located on tidewater, has rail connections, and ample space for enlargement. It is, however, too small for the local service and is only run during the peak to supply that portion of its load which the larger plant cannot supply through the tie line. It is equipped with two 500-kilowatt engine-driven sets and one 500-kilowatt turbo-unit. On account of service in a large summer resort the peak load of the smaller station comes in the hot weather period. The tie line, a 13,000-volt, three-phase cable about five miles long, is of No. 00 copper and is now loaded to its full capacity. As the peak of the larger plant comes in winter, the two stations can be run together effectively within the limits of their capacity and the capacity of the tie line, but the arrangement is inflexible as regards future service.

The study of the best lines of future development in a case of this kind is a broad problem, but it has been considered in the instance selected from three standpoints: first, building a new station on tidewater below the site of the smaller plant, using both the existing stations as distributing centers and enlarging the tie line; second, enlarging the smaller plant on its own site and increasing the tie-line capacity sufficiently to transmit the entire load to the city plant; and third, building a new station on tidewater about a mile from the city plant and distributing from the latter as a substation, with the present tie-line arrangemens to the smaller station. The last-named plan was found by careful figuring to be the most advantageous on account of the small transmission losses involved, the total production cost at the switchboards of the distributing centers with all fixed charges included being 1.78 cents per kilowatt-hour, compared with 1.82 cents in plan No. 1 and 1.79 cents in plan No. 2. Although there was found to be very little difference between the second and third plans in unit cost, the elimination of the main transmission of five miles in favor of a revised and shorter distribution, as laid out in the third scheme, was clearly an important operating advantage.

It is significant that the present total cost of 1.76 cents per kilowatt-hour must be slightly exceeded with the provision for caring for added loads, and the original location of the ultimate plant on rail connections with ample condensing water would have made the solution of the problem of expansion much less difficult.

Electrical Exports for August.

The usual monthly detailed summary of imports and exports of the United States, covering the month of August, has been issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C. From this are obtained the following facts regarding the electrical exports of that month.

Since August 1 corresponded closely to the beginning of the great European war, it was expected that the August electrical totals would be found "all shot to pieces." This is borne out by the figures at hand. The total for last August is but 45 per cent of the total of the corresponding month a year ago. As compared with the preceding month (July, 1914) the falling off is about 27 per cent.

For the four classes for which numbers of articles exported are given in the government reports, there were shipped last August 455 fans, 75 arc lamps, 27,438 carbon-filament lamps, 42,084 metal-filament lamps.

Articles.	August, 1914.	August, 1913.
Batteries	$ 38,722	$ 45,526
Dynamos or generators	114,570	134,136
Fans	5,528	46,408
Insulated wire and cables	51,236	219,736
Interior wiring supplies, etc. (including fixtures)	43,511	66,385
Lamps—		
Arc	1,620	10,387
Carbon-filament	4,338	15,835
Metal-filament	9,592	16,305
Meters and other measuring instruments	23,747	.....
Motors	118,490	419,280
Static transformers	33,609	156,727
Telegraph instruments (including wireless apparatus)	3,101	6,425
Telephones	78,403	189,160
All other	497,543	952,705
Total	$1,024,010	$2,279,015

Gas-Filled Lamps for New York Street Lighting.

Experiments are proceeding in New York City with 500 nitrogen-filled lamps. These have been installed on Broadway between Forty-fifth and Seventy-second Streets, on Seventh Avenue between Forty-fifth and Fifty-ninth Streets and north of 110th Street, on Madison Avenue, between Forty-sixth and Fifty-fourth Streets, and on Fifty-fourth Street between Fifth and Sixth Avenues.

Their substitution for arc lamps throughout the city would save, it has been estimated, $400,000 per year.

Electric Oven Saves from Poison.

In a recent poisoning case from bichloride of mercury, in Brooklyn, N. Y., the life of the patient was saved by the use of an electric oven in which his body was subjected to temperatures of 250 to 300 degrees Fahrenheit at intervals. The heat caused profuse perspiration, and the poison was thus eliminated and life saved, in spite of the fact that the kidneys had already ceased to function.

Lecture on Electricity in War Before New York Electrical Society.

The opening meeting of the season of the New York Electrical Society was held at the Electrical Exposition at the Grand Central Palace on October 9. Captain Samuel S. Robison, United States Navy, Bureau of Steam Engineering, Washington, D. C., delivered a lecture on "Electricity in War." There was a large attendance of the members of the Society and an intense desire upon the part of the public at large to be present necessitated some strenuous efforts upon the part of the doorman to keep some out. After the lecture an inspection was made of the exhibit by the United States Army and Navy Departments of electrical applications in modern warfare. Before the meeting a dinner was tendered to Captain Robison and Lieutenant McDowell of the Brooklyn Navy Yard, by Frank W. Smith, one of the directors of the exposition and chairman of the Lamp Committee of the National Electric Light Association. This committee had been in session during the afternoon and attended the lecture in a body. Other guests at the dinner, which was held at the Engineers' Club, were John W. Lieb, vice-president of the New York Edison Company; W. W. Freeman, vice-president of the Union Gas & Electric Company, Cincinnati, and T. C. Martin, secretary of the National Electric Light Association.

Steinmetz On the Future of the Industry.

The Pittsfield Section, American Institute of Electrical Engineers, met at the Maplewood Hotel, Pittsfield, Mass., October 7. President W. W. Lewis presided and outlined plans for a series of popular lectures during the coming winter. The address of the evening was by Charles P. Steinmetz, chief consulting engineer of the General Electric Company. His subject was "Every-Day Tendencies of Electrical Development," but the speaker digressed to discuss the European war, with some allusions to probable outgrowths of the struggle, chief of which, for America, will be the opportunity to become industrially and economically independent. He predicted the encroachment of Russia on Germany and later on France and England.

Dr. Steinmetz held that small lighting stations would be gradually eliminated, due to the increasing perfection of high-tension distribution, the competition of the able men in the employ of the large companies, and the economies of handling large volumes of energy from large generating sources.

Electrical Material for Guatemala.

Consul-General Stuart K. Lupton, Guatemala City, Gautemala, Central America, states that there will probably be an increased demand for certain electrical supplies, chiefly in the line of bulbs for incandescent lamps, wire, fuses and fittings. Heretofore these have been imported largely from Germany. The ordinary screw-socket lamps are used, on 120-volt, alternating-current circuits. It appears that electric fans are but little used, with the possible exception of a few at San Jose. It is also stated that cooking and heating utensils are forbidden by the electric companies under severe penalties. There appears to be a prejudice upon the part of some of the people against electrical appliances and instances have been known, according to the report, of such goods being held up at the custom house for months. It is stated that there is not much of a market for the larger electrical machinery as Guatemala appears to be entering one of the lean periods at this time. With over one-half of the ordinary exports looking for new markets and a possibility of much of the coffee crop being lost through inability to finance the harvest, and because of the practical impossibility of obtaining foreign exchange, Mr. Lupton is inclined to believe that 1914 and 1915 will be the worst years in the history of the Republic. The names of importers of electrical goods in the Guatemala district are on file with the Bureau of Foreign and Domestic Commerce at Washington, D. C.

Lectures at Brooklyn Institute.

The department of electricity of the Brooklyn Institute of Arts and Sciences, of which Samuel Sheldon is president and H. S. Wynkoop is secretary, has arranged a series of illustrated lectures dealing with electrical engineering to be held on different evenings during the winter. The first lecture has already been given by Charles P. Steinmetz. The others are as follows: January 11, Prof. A. N. Goldschmidt, "Recent Improvements in Wireless Telegraphy: and Experimental Telephony." January 18, Bassett Jones, "Color and Illumination." January 25, Prof. Vladimir Karapetoff, on a subject to be selected. February 1, C. E. Eveleth, "Electric Railway Systems." February 8, W. S. Andrews, "Recent Investigations in Luminescence." February 15, Elmer A. Sperry, "The Gyroscope, and Its Use on the Aeroplane." February 23, S. V. Gibson, "The Marvels of the Telephone System." April 10, Henry L. Lyon, "Power Distribution from Niagara." May 5, Putnam A. Bates, "The New York Fire Alarm System."

J. C. Bartlett.

The growth in popularity of the electric vehicle for both pleasure and industrial service has been more marked within the last six or seven years than at any other time in the history of this development. The providing of adequate facilities for charging the storage batteries upon electric vehicles and making available expert service for repairs and maintenance have probably worked to as great an advantage as advertising campaigns and rate reductions. For what we know with regard to the proper care of electric vehicles and for what we have learned with regard to ways and means for increasing their popularity we are indebted to a few pioneers who have had the hardihood to establish garages exclusively for electrics and have worked out a success in the face of almost insuperable difficulties.

When we think of the electric vehicle in terms of its popularity we think of Philadelphia. There the electric vehicle has been successfully introduced and its utilization is growing at an accelerating rate. One of the leading figures in the development of this interest in the electric vehicle is J. Crawford Bartlett, president of the Bartlett Garages, Incorporated, at Twenty-first and Market Streets, Philadelphia. Mr. Bartlett got into the electrical business through the contracting end in 1887. He was then 15 years old, and was still a student at high school. In his contracting business he had occasion from time to time to render expert service to the users of electric vehicles and he realized the opportunity that was ready for the man who made a study of conditions and organized to meet them. His first establishment for the repair and maintenance of electric vehicles was started in a small way in 1908. A year later it was necessary to move to a new building where he equipped one of the largest establishments in Philadelphia then devoted to automobile uses. Since that time it has been necessary to erect a building four times as large as the first one. The Bartlett Garages, Incorporated, is now in possession of a unique establishment where electric cars of every make and description secure the best and most expert attention for their maintenance and repair.

Mr. Bartlett has been successful in this field because he understands the practical working out of electrical repairs as applied to all of the equipment of the electric vehicle. Again, he is an energetic and enthusiastic advertiser who believes in correlating to his advantage all the elements which go to make up a harmonious working together of all the interests represented in the manufacture, sale and up-keep of the electric vehicle. He also is an ardent believer in the theory that if the public is properly educated along advanced lines with respect to the manifold benefits of electrical appliances that they will demand these goods. He is a believer in co-operative educational standards and in collective effort, and he is always opposed to destructive competition, characteristics which have won for him the esteem of a wide host of friends and acquaintances, including his most aggressive competitors.

J. Crawford Bartlett,
A Leading Electric-Garage Man of Philadelphia.

Chicago Jovian League.

The meeting of the Chicago Jovian League on October 12 was devoted to a final discussion of plans for the Jovian Congress at St. Louis. George Milner of Cleveland spoke briefly regarding the work of the Cleveland Jovians.

F. W. Harvey, Jr., Victor H. Tousley and Perry Boole were suggested as candidates for statesman and alternate for Chicago for the next year.

War Effects on London Electricity Supply.

The London electric lighting companies, especially those serving the western districts, generally have a very easy load during the months of August and September, as their fashionable and society residential consumers are out of town. This year they have been having a very busy time, for instead of the usual migration to the continent, etc., thousands have remained in town and many continental people are in residence also. It is indeed quite a regular feature of the London morning newspapers (the *Times* in particular) just now to publish a long list of advertisements in the French language, for the benefit of Belgian and French people of any means at all, who desire accommodation. This of course means extra current consumption in the districts affected. In addition the numerous extensive Government departments at Whitehall are open at all hours of the day and night with such continuous and great activity as has not been witnessed before in living memory. The many other buildings occupied by the innumerable organizations which are at work on matters of benevolent kinds in connection with the war are also fairly good consumers. In some of the other parts of London all factories and workshops engaged upon the provision of storing or manufacture of army and navy requirements are "hard at it," which again means consumption of electrical energy. On the other hand the street illumination is much reduced under official orders and no brilliant outside electrical or gas illumination of shops or public entertainment houses or railway station is permitted. An order in council authorizes the police to demand the reduction or extinction of any bright light that they consider likely to defeat the military precautions taken for preventing any Zeppelin that might get across the North Sea from picking out particular buildings upon which to drop bombs. Obviously this means a considerable drop in the consumption of electricity for exterior illumination. Taken altogether it is not expected that electricity supply works will materially suffer in revenue at present, though a probable falling off in consumption may be reckoned upon during the approaching winter months.

Empire State Gas and Electric Association.

The tenth annual meeting of the Empire State Gas and Electric Association was held in New York City on October 2. After calling the meeting to order, President J. T. Hutchings outlined the activities of the association during the preceding year. He called attention to the successful efforts which had been made to defeat the plan for state development of electricity from water power that had been proposed during the last session of the New York Legislature and mentioned the suggestions which had been made by the association for a program of development and utilization along the lines which had been recommended by the Water Power Committee of the National Conservation Congress. The organization of the Utilities Mutual Insurance Company as a result of the enactment of the workmen's compensation law was referred to and it was pointed out that while this company was not directly connected with the association it was made possible largely through the existence of the latter. In calling attention to the gas-filled tungsten lamp and other recent developments, Mr. Hutchings urged the members to use their efforts to push the sales of gas and electricity for purposes for which they were respectively suitable and satisfactory rather than to attempt to get business where the success was doubtful or development had proved that other means for accomplishing the desired purpose were more satisfactory.

After the treasurer had submitted the financial statement, C. G. Durfee read a report from the Electric Meter Committee. He called attention to a modification which had been made during the year by the Public Service Commission of the Second District in an order previously issued prohibiting the use of ampere-hour meters. He also described some new types of meters which were being developed and which it was expected would soon be on the market, with particular reference to inexpensive types of maximum-demand and intergrating watt-hour meters.

Scientific Gas Rates.

H. L. Coleman presented a very instructive paper on gas rates. He pointed out that with the usual straight-line rate for gas a large percentage of the consumers do not pay the cost of service to them, and that the small number of large consumers are compelled to bear this burden. His position was that such a system of rates was discriminatory against the large consumer and that from the company's standpoint it was unsatisfactory as it penalized the profitable customers and prevented the greatest possible use of the service by all. He maintained that there are two classes of costs, first the consumer's cost and second the output cost, and he therefore favored a rate which contained a fixed charge sufficient to cover the consumer's cost with a charge in addition for the actual gas used. He pointed out that a change from the old straight-line rate to this method, while merely requiring that each consumer should pay his proper proportion of the costs, constituted a substantial reduction to the large customers and an incentive to both the large and small customers to increase the consumption, as the 1,000-foot price, after the payment of the fixed charge, would be comparatively low. Such a system of charges had met, in his experience, with very general approval and had resulted in increased sales. The paper also dealt with the subject of special rates for special uses. Mr. Coleman's theory in this matter is that in order that discrimination may be considered unjust someone must be injured thereby. He claims that where differentials in price are made, based merely on the quantity used, unjust discrimination is bound to result. On the other hand, he does not consider that it is unjustly discriminatory to charge a baker a different price from that charged a dry-goods store, as long as all bakers are charged the same price and all dry-goods stores the same price. Numerous authorities are cited in defense of the further theory of competitive rates and an analogy is drawn between the rates for gas and the freight rates of railroads. The plan of making class rates for special uses is favored as being absolutely necessary in order to secure a larger amount of profitable business which would be a benefit to the company and to the community at large because it would bear a portion of the fixed charges. The general conclusion of the paper is that a rate system containing a customer's charge and a 1,000-foot charge is a scientific and proper one and that modifications of such a rate based on the use to which the service is put and independent of the quantity of gas actually used will result in advantage to all consumers and cannot be considered to be unjustly discriminatory.

There was considerable discussion on this paper, but the concensus of opinion appeared to be that the present straight-line rates which are commonly used in the gas business are not scientific and are unsatisfactory and that some sort of a two-charge or three-charge rate is desirable.

Incandescent-Lamp Situation.

At the opening of the afternoon session J. W. Lieb, vice-president of the New York Edison Company, read an interesting paper on the incandescent-lamp situation. Mr. Lieb reviewed the development of the incandescent lamp, mentioning the large number of low-grade lamps which have been put on the market from time to time and the necessity of electric central stations keeping control of the lamp situation in order to render service which would be satisfactory to their customers. He mentioned four ways in which the lamp situation might be handled by a public service company. First, furnishing of initial supply and renewals by the company without charge. Second, the supplying company charging a price merely sufficient to cover the cost of it. Third, the supplying company charging the usual list prices, thereby furnishing lamps at a profit. Fourth, the company not handling lamps in any way. Mr. Lieb discussed the pros and cons of each of these methods and strongly urged that whatever method be adopted it was extremely advisable for the company to keep control of the situation, as otherwise lamps would not be renewed as frequently as they should be and many low-efficiency lamps would remain on the circuits which would injuriously affect the service received by the consumer and for which the supplying company would be blamed.

In the general discussion following this paper, which was led by R. M. Searle, vice-president of the Rochester Railway and Light Company, all present appeared to agree that the company should keep control of the situation. There was, however, some difference of opinion as to whether this could not be done by the second or third method mentioned by Mr. Lieb, as well as by the first method. The secretary was instructed to communicate with the members of the association and ask for a brief outline of the policy at present pursued and the members' opinion as to the best policy in case the one in force is not entirely satisfactory.

Election of Officers.

R. F. Whitney submitted a report for the Nominating Committee and the following officers for the ensuing year were unanimously elected:

President, J. C. DeLong, Syracuse.

First vice-president, E. H. Palmer, Geneva.

Second vice-president, Stuart Wilder, Mount Vernon.

Treasurer, H. W. Peck, Schenectady.

Secretary, C. H. B. Chapin, New York City.

Executive committee—H. M. Beugler, Poughkeepsie; G. M. Cole, Plattsburgh; C. H. Graf, Albany; C. A. Graves, Walton; W. R. Huntley, Buffalo; J. T. Hutchings, Rochester; S. J. Magee, Ithaca; A. B. Tenney, Oswego; C. G. M. Thomas, Long Island City.

Electricity in Lock Manufacturing.

Extreme accuracy is essential in the manufacture of locks, and experience has demonstrated that this can only be obtained by the use of motor-driven machinery. This article comments on the advantages of electric drive and gives a detailed analysis of conditions in one modern establishment, having had experience with both steam and electric drive.

Only a very few of the countless thousands who in their daily life use the ordinary padlock have any conception of the multiplicity of operations necessary in the manufacture of this useful device. In one large factory every lock manufactured enters from 6 to 10 departments before completed, and in some departments 2 or 3 different operations are necessary. The significant feature, however, from the electrical standpoint, is the extreme accuracy demanded in each operation, especially in the manufacture of high-grade goods where accuracy within one one-thousandth of an inch is not unusual.

Considered from this standpoint entirely, it is hard to see how any other than electric drive can be countenanced in lock factories, even if the change over to motor drive would entail a greater operating expense. For many reasons, however, a few of which are discussed later, electric drive is more economical as well as providing for improved quality of product.

The general manufacturing conditions in lock plants are, with but few exceptions, similar to the ordinary machine shops, in which electric drive is now universally used.

While increased production is obviously the most important result attained by the installation of electric drive, it is also true that direct economies are very frequently effected in the power costs. Apart from the saving in energy made possible by the ability of the operator to shut down those machines not engaged in productive work, the elimination of shafting, belts, pulleys, idlers, etc., which form an indispensable part of any mechanical system, must of necessity result in important power economies, especially if it is remembered that mechanical drives often consume from one-half to four times the energy required by the machines themselves. With individual motor drive the maximum power is made effective at the tool itself.

In determining on the motor outfit for operating machine tools, one of the most difficult questions to decide is that of group or individual driving, and the most general solution is the combination of these two methods. The ideal method, and the one coming more and more into general use is to have the motor form an integral part of the machine. This method entirely eliminates belting and shafting, both main-line and jack shafts. The saving in the cost of these mechanical transmission parts partially compensates for

Punch Shop of Fraim Lock Company, Lancaster, Pa. A 15-Horsepower Motor Drives These Presses.

the installation of motor and controller.

The slip of belts introduces an uncertain factor in power supply which is entirely absent with individual motor drive. Furthermore, with individual motor drive the power delivered to the driven machine is automatically controlled and, in case of heavy demands, may greatly exceed the rated power of the motor, even for considerable periods of time. Thus a motor-driven machine is always capable of maximum production, while with belt drive and poorly adjusted belts the machine frequently balks before its full capacity is reached.

The even and easily manipulated speed control of machines individually driven increases their productive capacity to a very material extent.

The most important advantage to be gained in motor drive is a speed regulation adapted to the work. The convenience of securing the desired speed for maximum cutting when electric drive is used, will result in a material increase in output. On most of the belt-driven machine tools the average increase of speed per step is about 50 per cent. For instance, the spindle speeds might run as follows: 10, 15, 23, 53, 70, etc. It was found by closely watching the work on these machines that while in many cases the speed was evidently too low for a given piece of work, yet the increase of speed to the next step was so great that the tool steel could not stand it. The controller used is such that the average increase of speed per step is about 10 per cent, i. e., 10, 11, 12.1, 13.3, 14.6, 16.1, etc. It will therefore be seen that the output per machine, and therefore per man, will be considerably increased, since it is possible to more nearly approach the working limit of the tool steel. In every shop the labor item is the largest single item of expense, and the saving of a small per cent of a man's time will amount to quite an item at the end of a year.

A 7.5-Horsepower Motor in Fraim Lock Works Driving Automatic Machines.

Electric drive gives a steady power and permits great ease of speed regulation. The controller can be placed at the most convenient point, or, if advisable, two or more handles can be provided at different points, one being arranged to travel with the tool carriage. With the belt-driven machine more or less time is always lost in throwing a belt, and a negligent operator will not always take advantage of a change of speed on account of the exertion required to make the change.

With plenty of light and the absence of dust and dirt caused by shafting and belts, a workman surely ought to be, and usually is, inspired to do better and more efficient work.

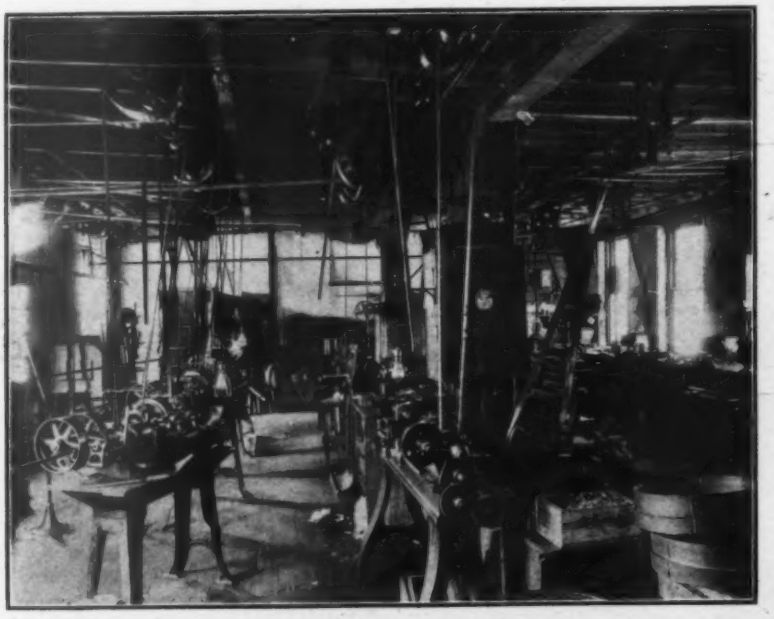
Another point to be considered in connection with motor drive is that the machines can be placed to the best possible advantage and, if it should be necessary to rearrange them, it can readily be done.

If it is necessary to work a few machines overtime, a lot of power will not be wasted in running a shop full of shafting.

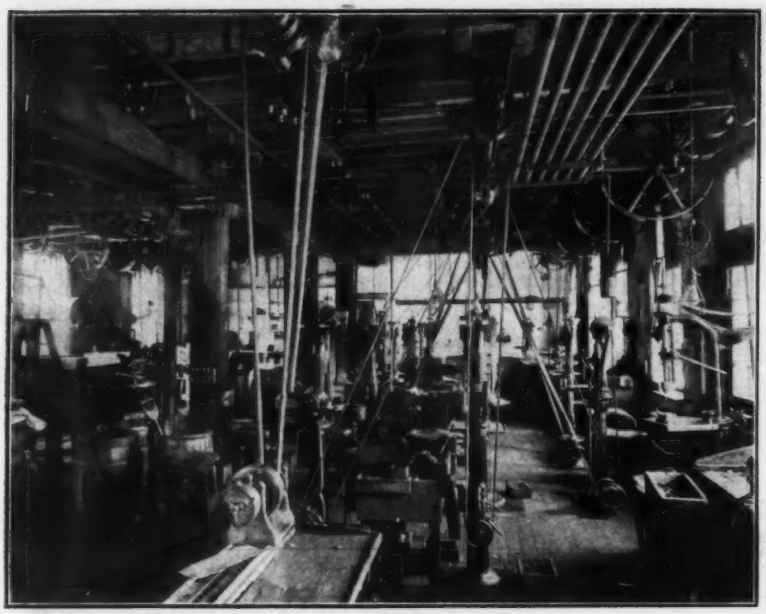
When a machine is not running it is not using power, whereas, in a mechanical driven shop, the shafting is always running. Experiments have demonstrated that in an ordinary shop the shafting requires as much or more power than the power required to run the machines.

The absence of shafting also simplifies the construction of the building, which is an important point to be considered when a new factory is to be installed.

While the foregoing advantages of individual motor drive are sufficiently important to justify a careful analysis in every instance where the question of power is being considered, still in lock manufacturing plants it is seldom found advisable to equip with individual motors. From the standpoint of



Section of Machine Shop in Lock Works, Showing Milling Machines.



Drills and Miscellaneous Machines in Lock Factory Arranged for Motor Drive.

financial investment small group drives are preferable, and even when so equipped marked economics are effected over steam-engine operation. The reduction in friction losses alone go a long ways in effecting savings that almost pay for the power required.

The Fraim lock works at Lancaster, Pa., furnishes an excellent example of the economies and advantages of electric drive and central-station service in lock manufacturing. This company previously employed a steam engine for operating the entire plant, but after an extended investigation by the Lancaster Edison Company of operating conditions covering steam and proposed electric operating costs, it was decided to install motors. A steam engine was retained to operate some of the departments during the winter months, and the plant is therefore particularly interesting, as it has permitted the management, after a careful study of conditions, to actually see month by month the difference in steam and electric operation. This plant, it may be said, is a strong booster for central-station service.

The Fraim factory manufactures a line of high-grade locks of various sizes and patterns under a trade mark that is well known. Brass, steel, cast iron and malleable iron are the materials used, but tests have indicated little or no variation in power consumption when handling different materials. The average output of the plant is 1,000 dozen locks per day of 10 hours, which requires an operating force of 300 men.

Steam and hot water are constantly required in the polishing and plating departments so when the change over to electric drive was made a 35-horsepower steam engine was retained, which is operated only during the heating season, or during the months of December, January, February, March and April. This engine drives a portion of the machine shop, connections being made from the engine pulley to the short lengths of shafting driving various groups of machines during the winter months. When steam is required for heating the buildings the steam engine is supposed to act in the capacity of a reducing valve between the boilers and the low-pressure heating system. The average coal consumption per day in winter is 2,500 pounds, while during the summer season the approximate coal consumption was 1,500 pounds daily.

In discussing the question of steam versus electric drive with the writer, a member of the firm was enthusiastic in his praise of purchased power and motor drive. He stated that there was a noticeable decrease in the production of the departments driven by the steam engine, especially when the steam pressure was allowed to fall. The speed of the driven machines was continually fluctuating and this affected to some extent the quality of the product, although special pains were taken to drive those machines only which were engaged in more or less rough work.

In the departments driven exclusively by motor it was stated that many advantages are apparent. In the grinding and polishing room considerable saving has been effected by the reduced wear and tear on emery wheels and in the automatic-machine department the production has been visibly increased. One important item of saving was in the electroplating department which is in continuous operation during the working day. Under the old system of drive it was necessary to run the engine during the noon hour, simply to operate the few machines in this department. Such statements as these from a manufacturer are indeed gratifying to the advocates of electric drive.

The first operation in the manufacture of locks is punching out the stock. In one of the accompanying illustrations is shown the punch shop of the Fraim company showing the machines

Section of Grinding and Polishing Department. Motor is at Far End of Room.

grouped in two rows with a motor in the center driving both line shafts. The motor is 15 horsepower, running at a speed of 1,120 revolutions per minute and drives 18 punch presses as well as a few miscellaneous machines. The machines driven are as follows: One Ferracute EG-52 coining press; four Ferracute P-2 punch presses, flywheel 30 inches in diameter, rim 5 inches by 3.25, speed 110 revolutions per minute; two Ferracute P-1 punch presses, flywheel 26 inches in diameter, rim 4 inches by 3.5 inches, speed 130 revolutions per minute; six Ferracute P-2 punch presses, flywheel 30 inches in diameter, rim 5 inches by 3.5 inches, speed 110 revolutions per minute; five Ferracute P-3 punch presses, flywheel 36 inches in diameter, rim 6 inches by 3 inches, speed 95 revolutions per min. ute. One automatic screw machine, one automatic cutting-off machine and a die grinder are also driven by this motor.

From the punch shop the stock goes to the machine shop, where the numerous parts entering into the lock are machined. There are three motors aggregating 4.75 horsepower in this department, which also drive the grinding and polishing machines. The machine shop and grinding-room operations are so closely allied that the arrangement in the Fraim plant has saved considerable time in transferring material from one department to another.

A 7.5-horsepower motor, running at a speed of 1,120 revolutions per minute drives the following machines through 60 feet of line shafting and 81 feet of countershafting, supported by 8 and 22 hangers, respectively: One Robertson No. 2 hack saw, one Hamilton 10-inch drill, one Garvin No. 4 plain miller, two Besley No. 10 double-end disk grinders; one 10-inch by 4-inch engine lathe; three Cleveland automatic screw machines; one double emery grinder, wheels 8 inches by 2 inches; one Fairbanks 14-inch by 6-foot engine lathe, one Hamilton lathe of the same size as above, one Garvin single emery grinder, one Stehman & Swan speed lathe, one 12-inch by 2-inch grindstone, two 15-inch by 30-inch tumbling barrels, operating at a speed of 80 revolutions per minute; two 12-inch by 14-inch tumbling barrels, one 32-inch by 42-inch tumbling barrel, one 12-inch rip saw, three special automatic grinders, one Browne & Sharp automatic screw machine, one Rivett jewelers' lathe, and one Stehman & Swan cylinder riving machine.

A 10-horsepower motor, 1,120 revolutions per minute, in the machine shop drives seven Garvin No. 1 hand millers, one Garvin 14-inch hand miller, one Burke No. 1 hand miller, three double emery polishers, 8 by 2 inches, 6 by 4 inches and 14 by 1.5 inches respectively; two double brush polishers, 6 by 2 inches and 12 by 1.5 inches; one double buffing wheel, and two double leather-faced buffing wheels, 12 inches by 2 inches.

The remainder of the equipment in the machine shop is driven by a 30-horsepower induction motor running at a speed of 1,120 revolutions per minute. The equipment comprises 13 Barry & Zeiker 6-inch drills, two leather-faced buffing wheels, one 8-inch by 3-inch emery polisher, one sensitive drill, one 6-inch speed lathe, one 1.75-inch metal saw used to slot key cylinders; two 8-inch by 2-inch double emery polishers; one 12-inch by 2-inch double emery polisher, one 12-inch by 2-inch double buffing wheel, one 12-inch by 2-inch leather-faced double buffing wheel, two 4.5-inch by 24-inch wooden rolls, and one Champion No. 1 blower, 1,200 revolutions per minute.

In the japan room two motors aggregating 12.5 horsepower are installed. Both are of the squirrel-cage induction type and operate at a speed of 1,700 revolutions per minute. The five-horsepower motor is connected to a 10-foot line shaft and 13 feet of countershafting driving three 24-inch by 30-inch tumbling barrels, and one American Gas Furnace Company No. 1 pressure blower, 300 revolutions per minute, which supplies air at one-pound pressure to a Crawford japan oven. The larger motor drives directly a B. F. Sturtevant blower used to exhaust dust from the polishing machines. This exhaust blower outfit runs at a speed of 800 revolutions per minute.

Adjacent to this motor is a 5-horsepower motor, 1,120 revolutions per minute, driving from a countershaft an air compressor and one Champion No. 2 fan.

The electroplating department is where the parts get their final treatment, preparatory to assembling. In this department a 15-horsepower motor is installed which drives, through 60 feet of shafting, one Eager 9,000-watt, 6-volt plating dynamo, 600 revolutions per minute; one 6-inch by one-inch double polisher, and two 18-inch by 24-inch eight-sided electroplating drums.

Corner of Electroplating Room, Showing Dynamo and Motor-Driven Agitators.

In the assembling department a 5-horsepower motor is installed, 1,700 revolutions per minute, which drives six high-speed polishing heads. These machines give the final polish to the locks and they are then inspected and packed.

All motors installed in this plant are of the squirrel-cage induction type. Energy at two-phase, 60 cycles, 220 volts is supplied by the Edison Electric Company of Lancaster. The approximate electrical energy consumption per 100 dozen locks manufactured is 20.2 kilowatt-hours.

The monthly kilowatt-hour consumption for the past year is as follows:

October, 9,560; November, 8,230; December, 3,120; January, 3,430; February, 1,730; March, 2,460; April, 2,470; May, 2,620; June, 6,840; July, 7,830; August, 7,000; September, 8,090.

Commercial Practice
Management, Rates, New Business

STANDARDIZED SERVICE CONNECTION PRACTICES.

By Harvey E. Hemenway.

Central stations should adopt standard practices regarding the connection of consumers to their lines. That is, they should compile and follow certain set rules relating to the making of service connections, and should connect no consumer until his installation has satisfied these rules. Most of the large central stations have standardized their usages in this respect; but by far the majority of the smaller ones have not. This is likely to cause them difficulties, because there should be no discrimination between consumers; one consumer should receive precisely the same consideration as any other. It is the intent of this article to outline a schedule of standard practices that can be used by the smaller companies which do not now follow fixed customs in this department of their work. The suggestions given will not, without modification, apply to every case, but they will at least serve as a guide to assist in the formulation of methods that will satisfy any specific condition.

Line Extensions.

Where the estimated cost of an extension to the overhead pole-line system to serve a consumer does not exceed twice the probable annual revenue to be derived therefrom, the central-station company can usually well afford to make such extension at its own expense. If it is difficult to estimate the probable income to be derived by virtue of the extension, it is sometimes possible to secure the consumer's guarantee for an amount that will bring the annual revenue to the company up to the required amount.

In case the estimated cost of the extension exceeds the probable income for two years, and the customer does not wish to make a guarantee, payment can be arranged on this basis. The prospective customer can pay to the company in advance a sum equal to 15 per cent on the excess cost of the extension (over and above that equal to two years' revenue) for a certain period. This period should be estimated by the central station. It is the period that will probably elapse until, due to development, the first cost of the extension is equal to twice the annual revenue. This 15 per cent is an annual charge, and should cover interest, depreciation and maintenance on the portion of the plant tied up in the extension. This charge is in the nature of a rental, and should not, of course, be returnable to the consumer. The title to the extension obviously lies with the company. Where such extensions are made, the central station should always arrange with the consumer to furnish the right-of-way required; and the central station should also reserve the right to serve from the extension consumers other than those for whom the extension is built, provided it so desires.

Frequently the promoters of subdivisions desire both telephone and electric light service, but desire that arrangements be made to carry both the electric-light and the telephone wires on the same poles. The intention is to maintain the number of poles on the property to a minimum. In such cases it is frequently a profitable course for the company to erect the pole lines required at its own expense. The poles can be located at points mutually agreed upon by the promoter and the central-station representative. The promoter, if possible, should be required to give a perpetual easement for the right-of-way. If it is not possible to secure a perpetual easement, a long-term easement should be secured. The central station can then rent attachments on its poles to the other public-service corporations who desire to use them. Central stations should always retain the right to extend such pole lines or to connect from them any consumers outside of the subdivision who desire service.

Service Connections.

It is a fair and equitable practice to make the service connection for any consumer free of charge provided it does not require a run in excess of 150 feet. It is also fair to include without charge the setting of one pole in this 150-foot run where such is necessary. By a service connection or service wire is meant that portion of the wire plant between the pole line in the street or alley and the entrance into the customer's building.

Where a run of more than 150 feet is needed, an extra fee should be demanded of the customer. One fair basis of making this is to charge the consumer with the cost of that portion of the extension which exceeds the 150-foot limit.

Frequently it is possible to make this charge on a basis of cost plus 10 per cent. Arrangements should be made so that all extensions made under this arrangement will remain the property of the company.

Where underground connections are required, the company can usually profitably afford to furnish to the customer, without extra compensation, an underground service extending from its mains to a point two or three feet inside of the basement walls. Where the underground service must extend further than two or three feet within the wall, the consumer should pay the cost of such excess extension, or should pay the cost plus 10 per cent.

Wiring Requirements.

Every central station should require that interior wiring systems satisfy certain requirements before they are connected to the company's mains. It is a good plan to make a rule that all residences, apartment and flat buildings having a connected load in excess of 660 watts, or having two or more branch circuits should be wired for a convertible two-wire or for a three-wire service. When the interior wiring circuits are so arranged, not more than two-thirds of the outlets on any one floor should be supplied from one side circuit of the three-wire circuit. Experience has shown that the basement and attic can be excluded from the provisions of this rule. Where buildings are wired as above suggested, the company can connect them either two-wire or three-wire as is most desirable.

As a general proposition, commercial loads, that is those in business houses, places of amusement and churches should have a three-wire service and should be connected three-wire. Any lighting installation having a load in excess of 1,000 watts, or buildings having a floor area in excess of 1,000 square feet should always be wired three-wire. The outlets on this three-wire circuit should be so divided on the two side circuits that each will be equally loaded as nearly as possible under all conditions.

In each and all cases, wiring should be so proportioned that the drop in voltage with all lamps turned on will not exceed one volt between the point of entrance and any lamp on the circuit. In buildings that require emergency or exit-lighting circuits, two sets of three-wire services should be provided. One set should serve the emergency exit lights exclusively; the other set can

serve the general lighting in the building.

Central stations should insist that all wiring be installed strictly in accordance with the regulations of the National Electrical Code.

Service Entrances.

The central station should always demand that the contractors who wire buildings locate the service entrance into the building at a point most convenient to the company's mains. Where the nearest pole line is located in an alley or along rear lot lines, the service wires should be carried out of the building through its rear wall or through a side wall. The wires should always come out near the corner of the building closest to the pole from which service is to be derived. Obstructions between the building and the nearest pole may sometimes make it necessary to take the service from the next nearest pole, and the wiring contractors should consider this in locating the entrance outlet. The entrance wires should be bushed through the wall with porcelain tubes slanting downwards so that a drip loop will be afforded. A length of entrance wire at least two feet long should be left extending from the building by the contractors to afford ample material whereby the central station can connect to the conductors that it installs from the pole to the building.

Where the nearest pole line is on a street, the entrance wires should be brought out of the building at its side near the front. It is obviously undesirable to bring them out of the front of the house, and furthermore it is seldom necessary. It should never be necessary for the central station to install more than one or a maximum of two sets of brackets on the building to reach the service entrance.

Underground entrances can be made on the basis indicated in a preceding paragraph. It is always advisable to secure from the prospective consumer a written order stating exactly where an underground entrance is to go into a basement. Underground entrances are expensive and difficult to install, and if there is a misunderstanding as to the location, where the entrance is to be cut through, considerable expense and delay may result.

Meters.

Central stations should have a rule to the effect that meters must always be installed in clean, dry places where they will be readily accessible for reading. They should not, if it can be avoided, be located in kitchens; if they are, a coating of grease and dirt will ultimately accumulate on them. They should never be mounted where they will be exposed to heat, or to excessive vibration; that is, they should never be mounted above stoves or furnaces, or on thin partitions that vibrate when the doors in them are slammed. A rear hall, a pantry, or a light, dry location in the basement constitute the best places for installing meters. They should never be mounted in an attic, in a dark closet, or inner room that is locked and therefore difficult of access.

Some central stations have adopted a rule to the effect that all wiring between the point of entrance and the meter shall be installed in wrought-iron conduit. Furthermore this wiring should always be concealed. This ruling is designed to prevent the theft of energy. For the same reason the run of wiring between the point of entrance and the meter should always be as short as possible. It is obviously necessary to provide in buildings of certain classes, such as, for instance, apartments and business houses, for the installation of more than one meter, so that the energy to the different tenants can be measured individually. The wiring contractors must consider this feature when they are laying out the wiring system in the structure.

Maximum-demand meters are also required by some companies for certain classes of subscribers, and provision should be made for them where they will be used. Frequently wiremen will place a board upon which the meter is to be mounted so close to some member of the building that it is impossible to remove the cover or to examine the interior of the instrument. Meter boards should always be so installed that the meter is not closer than eight inches to any joist, pipe, column, heating duct, or other obstruction above the meter. There should be a horizontal distance in front of the meter of at least three feet, so that it can be read and inspected without difficulty. Every meter should be located within seven feet of the floor, and not nearer than five feet. Because of the fire risk involved, service entrances should not be made into attics unless all wiring in the attic is installed in wrought-iron conduit.

The central station should insist that the wiring contractors provide suitable boards upon which the watt-hour meters can be readily mounted. The boards should be at least 12 inches square and of seven-eighths-inch clear, soft-wood stock; and should be given one coat of paint or varnish on all surfaces to prevent warping. The above dimensions apply to installations where but one meter is required. Where more are necessary, the size of the board must be increased proportionately, and the board should be one continuous slab. It should not be composed of small scraps nailed together. The board should be securely fastened to the wall, preferably with flat-head wood screws. Where the wiring is being done in a building under construction, the board can be so mounted that its surface will come flush with the finished surface of the plastered wall. Where the board is mounted in an old building, it can be fastened to the surface of the wall.

The practice of making provision for the watt-hour meter on panelboards, or in distributing cabinets, is increasing. Where a meter is to be so located, the wiring contractor should drill the panel and provide bolts in it for securing the meter in accordance with templates and directions that should be furnished by the company.

The wiring contractors should always provide enough wire at meter locations so that the loops to the meter can be made without splicing. Sufficient flexible tubing should, in knob-and-tube installations, be left by the wiremen on the wires so that contact with the wall surfaces will be prevented. The wires should be brought out of the wall so that it will not be necessary to cross them in order to route them to the proper terminals of the meter.

The practice of providing sheet-steel boxes specially designed to contain all of the wire about a meter and the meter terminals is becoming more prevalent, particularly in connection with wrought-iron conduit installations. This practice should be advocated, inasmuch as it insures a further protection against theft of energy, or tampering with a meter.

In three-wire meter installations, a potential wire, which should be in one continuous length, should be led through from the service entrance to the meter location. It should be soldered to the outlets to the neutral wiring.

Provisions for Motors and Other Devices Consuming Considerable Current.

In these days, the central station is frequently called upon to connect to its lines devices such as motors, electrolytic apparatus, rectifiers, welding machines, and heating apparatus that will take great surges of current at starting. Unless suitable provision is made, these high starting currents will seriously interfere with the voltage regulation, and may even trip the circuit-breaker in the central station. To prevent such occurrences, it should be stipulated that no device will be connected with the company's line that takes a starting current in excess of 2.5 times full-load current.

Alternating-current motors of capacities in excess of 0.25 horsepower should always be wound for at least 220 volts; or if they are not so wound, a starting device should be installed in connection with them that will limit the starting current to the value above indicated. Single-phase motors of capacities in excess of 10 horsepower, should not, as a rule, be installed, because of the ex-

cessive starting currents that they require. All large alternating-current motors should be either two-phase or three-phase. Where alternating-current motors of capacities greater than 25 horsepower are required, they should be of the wound-rotor type, which will permit a heavy load to be started without excessive current.

All direct-current motors of 0.5 horsepower and greater should be wound for at least 220 volts, and the starting and controlling equipment for them should be carefully selected so that their starting currents will not be excessive.

As a general proposition, electrolytic and industrial heating devices which require any considerable amount of energy should be wound for at least 220 volts, or they should be equipped with current-limiting devices to eliminate the possibility of heavy surges at starting.

Massachusetts Lighting Companies Compared.

A study of the statistics given in the returns of Massachusetts electric lighting companies for the year ended June 30, 1914, shows that marked gains have been made in volume of electricity generated and in the several departments of distribution. Among the seven important companies operating in cities outside the Boston territory, the Worcester Electric Light Company is notable in the increase in output as compared with last year, the figures showing an added volume of more than 9,000,000 kilowatt-hours, as compared with the year which ended June 30, 1913. The United Electric Light Company of Springfield increased its output about 1,500,000 kilowatt-hours, purchasing nearly a million units of the Amherst Power Company, which generates by water power obtained from the Connecticut and Deerfield Rivers. The Worcester company likewise obtained 1,500,000 kilowatt-hours of the Connecticut River Transmission Company, which is the transmission company handling the energy generated at Vernon, Vt., and at four hydroelectric stations on the Deerfield River. The recorded cost of about one-half cent per kilowatt-hour indicates the economies of using these sources of power supply.

The seven companies compared in the accompanying table operate under somewhat similar conditions, in territory with population ranging between 100,000 and 150,000. Apart from the exceptions noted, the energy is generated by steam power. The advantages accruing to the companies located in cities on the seaboard, viz., Cambridge, Fall River and Lynn, in the lower cost of coal, is obvious, interior cities paying 40 to 65 cents more per ton than those enjoying water delivery.

The increase in the power load all along the line is indicative of the gradual motorization of factories and shops, particularly those located in or near the important centers of population. The sustained sales of energy for commercial lighting show that the increased efficiency of incandescent lamps has not resulted in a diminution of general consumption in that department. On the contrary, sales of current for commercial lighting were increased by the Fall River and Worcester companies about a half million kilowatt-hours each, and the Malden company added about 325,000 kilowatt-hours over the preceding year.

The characteristics of the several communities served by the seven Massachusetts companies noted are somewhat various, thus accounting for the varying amounts of energy consumed per customer, and the differing power loads. The house-lighting business in Cambridge is diminished to a certain extent because of the fact of its being a University town, from which a large number of its inhabitants are absent three months of the year. The comparatively large average lighting consumption found in Springfield and Lowell is due in part to large factories lighted by incandescent units. The remarkably large number of customers in the former city speaks well for the aggressiveness of the company's management in pushing the introduction of electricity for house lighting and for power in this the smallest of the seven companies' territories now under discussion.

It is noteworthy that Lynn, with less than the average population in its territory, shows the largest number of customers for lighting service. This company is a combination gas and electric company, and it is evident the electric end of the business does not suffer from being in close relation with the gas department. The fact that the Lynn company has more than 30,000 gas customers makes it evident that the electric side of the business has a large reserve field, should the company wish to push the electric supply at the expense of the gas business.

Some of the companies show a larger ratio of operating expense to gross earnings than they did for the year before, but the growth in business comfortably provides for the larger proportion of outgo, and the conservative policy on which the Massachusetts companies are conducted makes them notably safe businesses and their securities, with scarcely an exception, well above par value in the investment market.

COMPARATIVE STATISTICS OF SEVEN LEADING MASSACHUSETTS ELECTRIC LIGHTING COMPANIES, YEAR JUNE 30, 1913—JUNE 30, 1914.

	Cambridge Electric Light Company.	United Electric Light Company, Springfield.	Worcester Electric Light Company.	Fall River Electric Light Company.	Malden Electric Company.	Lowell Electric Light Corporation.	Lynn Gas & Electric Company.
Population of territory	104,839	99,114	149,223	126,860	116,753	119,884	104,509
Number customers	4,270	5,722	9,489	4,519	7,340	3,647	9,677
Kilowatt-hours generated	12,404,482	*26,914,708	†30,031,300	13,578,430	10,100,956	12,785,899	12,005,080
Kilowatt-hours sold for commercial lighting	2,613,766	6,637,349	5,103,767	2,550,223	2,182,892	2,549,684	3,814,720
Number commercial lighting customers	3,825	8,001	8,875	4,286	6,983	3,205	9,126
Average yearly consumption kilowatt-hours	683.34	829.56	575	595	312.6	795.53	418
Number municipal arc lamps	170	1,414	1,406	1,020	127	729	636
Number municipal incandescents in 50 carbon and 40-watt tungsten units	5,692	2,282	4,064	950	3,283 †502 220-watt tungsten	7,402	2,241
Power load—motors in kilowatts	7,109	10,054	11,384	4,910	2,548	6,306	5,243
Number power customers	445	721	614	209	341	436	445
Year's coal consumption in long tons	14,076	26,975	34,049	14,989	12,954 coal 1,250 coke	16,876	15,206
Kilowatts generated per ton coal	881.25	997.76	882	905.9	711.13	757.64	789.5
Ratio of operating expenses to gross earnings, per cent	58.25	55.9	52.2	60	66.59	65.3	78.1
Average cost of coal	$3.933	4.33	4.18	3.93	4.599 Coke $4.00	4.585	3.73
Maximum gross lighting rate	.11	.12	.11	.10	.12	.12	.11
Maximum gross power rate	.05 5/9	.05	.08	.06	.045	.11	.06

*In addition, 985,300 kilowatt-hours were bought from the Amherst Power Company.
†In addition, 1,532,726 kilowatt-hours were bought from the Connecticut River Transmission Company.

Electric Sign Data

Appropriate Form of Church Advertising.

Advocates of church advertising are still in the minority, in most cities, and this may very well be attributed to the fact that they have confined their efforts largely to urging the use of newspaper and billboard space for the purpose of securing desirable publicity for the churches. There was formally dedicated in Cincinnati, however, on Sunday, September 20, a piece of church advertising which is not only highly effective, but which is so appropriate for its peculiar purpose that not a word of criticism can possibly be leveled against it. It is an enormous electric sign, in the shape of a cross, and it is hung 12 feet above the sidewalk in front of the Trinity Methodist Church.

The church stands on one of the cross streets, in a relatively retired position, although it is close to the center of the city. Intersecting this street, however, half a block away on each side, are two of the busy business streets of the city, Race and Elm, and on these there is a constant stream of traffic all day. The advertising value of a sign sufficiently large and striking to attract the attention of people passing on these streets, as well as on those further away on each side, was therefore obvious; and the idea of using a large electric sign was taken up with enthusiasm.

A sign in the shape of a cross was at once suggested as the most appropriate design possible, and this idea was worked out by the Federal Sign System (Electric) in Cincinnati.

As the church building stands back several feet from the sidewalk, a special structure was required to support the sign, which, on account of its size, is extremely heavy. The vertical section is 18 feet long, while the cross-arm is 8 feet long, the width of each being about two feet. A sign of this size obviously calls for a structure of some strength to support it, and the sign company took ample pains in this respect. The principal support of the sign is a 38-foot hollow iron post, five inches in diameter, which is sunk eight feet into the ground at the edge of the church property. This post is steadied and supported by steel angles and rods fastened to the church building, while the sign is attached to it by rods, braces and chains which make it practically rigid, the whole structure being firm enough to make it absolutely safe.

The background of the sign is enameled in dark blue, 16-inch white letters being used, set with a total of 250 five-watt 13-volt lamps, wired in series. The sign was purchased outright, $500 being the price, and the church will take care of its maintenance, the cost of current being about 12 cents an hour. The sign is lighted every night.

The completion of the sign was made the occasion of impressive dedication ceremonies, attended by special music and presided over by high church dignitaries, including Bishops Earl Cranston, David H. Moore and others, who paid a tribute to electrical advertising.

The sign has been the subject of a vast amount of favorable comment, from those interested in church work as well as from those who regard it simply as an effective piece of electric-sign advertising. As something of a new departure in church publicity, however, it should be worth keeping in mind by electric sign men and central stations.

It is true that a church here and there, like the one referred to, has seen the effectiveness and appropriateness of this means of keeping its name and its location before the public, by day as well as by night; but the vast majority use neither this nor any other method of gaining advertising, which has been pointed out by many earnest church workers as one reason why some churches have found their attendance falling off. The church which can back up its traditional position as a light in the community by a dignified electric sign, making it a light in fact, can hardly help gaining by it.

Church sign constructed by Federal Sign System (Electric) at Cincinnati.
Vertical section is 18 feet by 2 feet; horizontal section 8 feet by 2 feet.
There are 250 five-watt, 13-volt lamps used.
Background is of blue enamel.

Electrical Construction

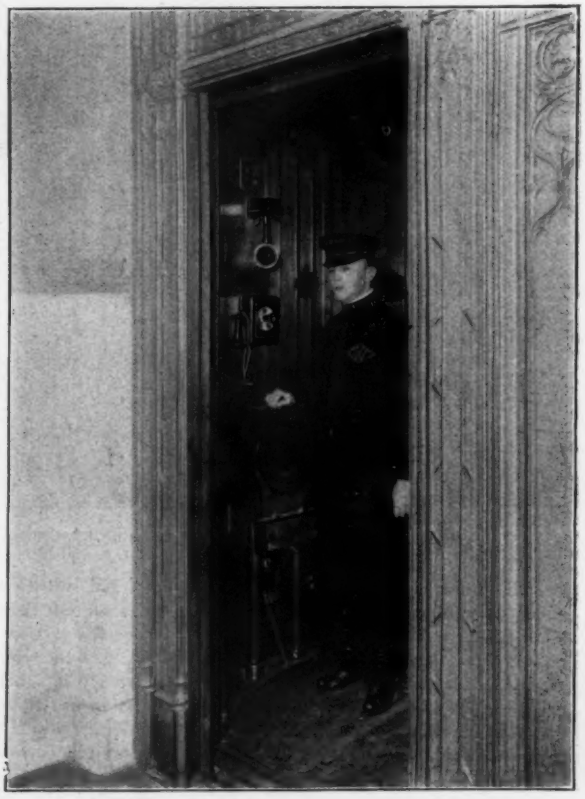
ELEVATOR DISPATCHING BY TELEPHONE.

A Description of the System Used in Several Large Buildings.

To facilitate the operation of elevators in office buildings, an elevator telephone system is employed in several large buildings. In all of the buildings in which this system has been installed it has proved remarkably successful, especially in the Woolworth and new Municipal Buildings in New York City, where the elevator traffic is exceptionally heavy. In each of these buildings during the morning rush period nearly two thousand people are carried to their respective offices within a quarter of an hour.

The elevator-service signal system in these buildings is a combination of the Western Electric Company's loud-speaking telephone and the Elevator Supply Company's elevator lamp-signal system as described in our issue for May 23, 1914. The passenger upon entering an elevator notices on one side of the car a wall telephone set and directly above it a loud-speaking telephone receiver. This apparatus is used for providing means of instant communication between the elevator dispatcher and the car operators.

Car Telephone Installation, Municipal Building.



Car Telephone Installation, Woolworth Building.

The dispatcher wears a telephone head set consisting of a head receiver and chest transmitter. His small telephone switchboard is electrically connected to all the elevator cars. Mounted in the switchboard there are the usual cords and plugs, jacks and keys for the dispatcher's signaling and for making connections with the car telephones. Placed directly in front of the dispatcher is a bank of lamps corresponding to the number of elevators under his supervision and the total number of floors having elevator service. The lamps for each elevator are mounted in vertical rows, two rows per car—one to indicate the upward movement, and the other the downward movement. As an elevator arrives at the different floors, the corresponding lamp in front of the dispatcher's board is illuminated. The scheme of connections employed for this indicator is similar to that employed for the position indicator described in our issue of July 18, 1914, except that two rows of lamps are employed for each car.

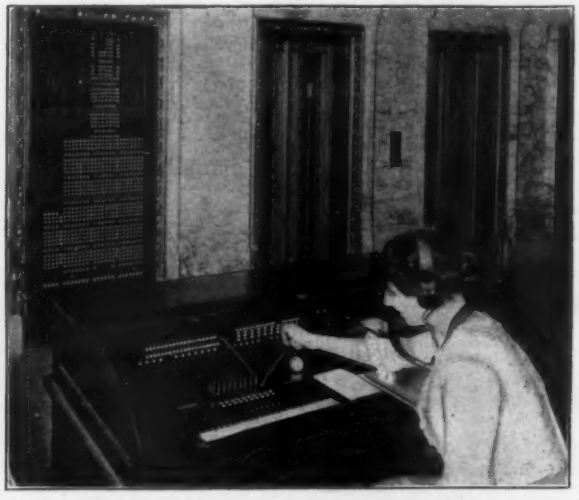
The means for instant communication is the special feature which makes possible the satisfactory dispatching of the elevators. When it is necessary for the dispatcher to give orders or in-

structions to the car operator it is essential that it be done with the least possible delay. To talk to the operator the dispatcher "plugs in" on that line, and uses the loud-speaking receiver. This loud-speaking receiver is a very sensitive telephone receiver, being equipped with a horn so designed as to distribute the vocal sounds under the best possible acoustic conditions. It is not necessary for the operator to stop his car while receiving these instructions, and should it be necessary to immediately reply to the dispatcher, the operator can talk directly into the loud-speaking receiver, using it as a transmitter. If the operator desires to call and talk to the dispatcher, he needs only to take the receiver off the hook of the standard telephone, so signaling the dispatcher, who "plugs in" on the operator's line and talks.

By means of the lamp-signaling system combined with the loud-speaking telephone apparatus in the dispatching of elevators in our modern buildings, a very satisfactory type of elevator service is obtained. The dispatcher can observe every move and stop of each elevator. When irregularities or delays occur the operator can signal and, if necessary, talk to the dispatcher, and thus facilitate the straightening out of the kinks in the elevator service. Most important of all, however, is the fact that the dispatcher can be in instant communication with the operator in each elevator, for by means of the loud-speaking telephone instructions can be conveyed without stopping the even swing of traffic.

In the Woolworth Building a number of double push-button switches are placed near the dispatcher by means of which she can transfer a floor-lamp signal from the nearest approaching car to the next one if desired. This is accomplished by placing the dispatcher's push-buttons in series with the corresponding buttons for the same purpose in each car as described in our issue of May 23, 1914.

Elevator Dispatcher, Municipal Building.



Elevator Dispatcher, Woolworth Building.

Segregation of Contracts Upheld in Pennsylania.

The Act of May 1, 1913, requiring separate specifications and direct bids for plumbing, heating, ventilating and electrical work on public buildings in the state of Pennsylvania was upheld in the lower courts of the city of Erie, Pa. A bulk contract was awarded a construction company for the entire work on the third floor of the city hall involving plumbing, heating, ventilating and electrical work. When the case was brought before the court it overruled the contention of the city attorneys that a later act of the Assembly pertaining to third-class cities repealed certain portions of the act of May 1, 1913. The attorneys for the city of Erie have filed notice of an appeal to higher courts.

As a result of the efforts of the Joint Conference Committee of the Pennsylvania Master Plumbers, Steam and Hot-Water Fitters, Ventilating and Electrical Trades' Associations the contracts for a new high-school building will be segregated and re-advertised.

Electricians' Strike Does Not Interfere with Utah State Fair Illumination.

After several consultations between O. A. Honnold, electrical engineer, and William M. Scott, superintendent of lines and electric service of the Utah Light & Traction Company, and the representatives of the company's linemen and trouble men who had gone on strike as a result of the inside wiremen's strike, they returned to work on Monday, October 5. It is understood that while a few minor differences between the company and its men were not definitely settled at the time, that these will be taken up immediately and adjusted. Governor William Spry was at a meeting with committee appointed by the executive board of the Salt Lake Federation of Labor in an effort to solve the strike problem at the State Fair Grounds resulting from the strike of the inside electrical workers belonging to Local No. 354, but no decision was reached and the executive board reaffirmed its previous action in placing the State Fair on the unfair list. The fair, however, is being held with apparently no serious effects as a result of the strike, the illumination display this year being far superior to that of any previous year.

Canton Building Code to Eradicate Faculty Wiring.

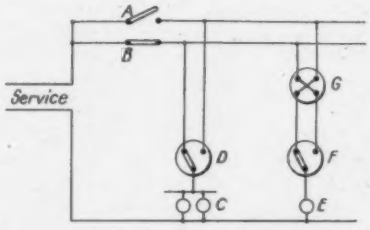
Measures to eradicate faulty electric wiring in Canton, O., are included in the new building code of the city, which will be published shortly. The Fire Prevention Committee of the National Board of Fire Underwriters has criticized the city's former lack of appropriate regulations in this respect, and the new code is intended to remedy this by proper standards and inspection.

Wiring for a Master Switch.

In planning the wiring for a modern residence it was recently required to have all the lights in the building controlled by a master switch at one point. This problem would not be a hard one ordinarily, but it is somewhat complicated when it is necessary to have certain lamps, such as those lighting the halls, controlled from more than one point locally. The accompanying diagram shows the wiring arrangement, which could be extended to any number of branch circuits.

The master switch consists of two single-pole switches A and B, of which A is normally open and B closed. C represents a group of lamps controlled from one point by means of a two-way switch, D. E represents a hall lamp controlled from either of two points, F and G. At F there is a two-way switch and at G a reversing switch which serves to interchange connections between the two wires coming from switch F and the two wires coming from the master switch.

With the master switch as shown all lamps can be controlled from the local points. If switch A be closed all lamps are lighted independently of the position of the local switches. If switch B be opened while A remains open all lights will be extinguished. Of course, to restore local control of the lights, the master switch must be restored to the normal position, which is with A open and B closed, or B open and A closed.



Wiring for Master Switch.

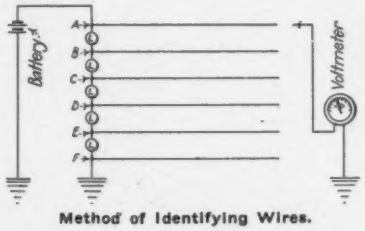
Cincinnati to Tax Electrical Contractors.

The city of Cincinnati is considering imposing a license tax on electrical contractors of $25 for an initial license and an annual fee of $5 thereafter. The ordinance providing for the license fee also regulates the electrical business in the city, incidentally, a board of examiners being provided for. An additional revenue provision requires a fee of $1 for each permit to handle a contracting job. The inspection of all work is provided for. A special license is to be issued, as well, to those employing electricians in their own plants. The electrical contractors are vigorously opposing the proposed measure, on the ground that there is no reason why they should be singled out for taxation, and that the license fees provided for are excessive.

Identifying Wires.

While working alone in a building I had to identify a number of conductors run between two distant points. Not wanting to waste time in going back and forth from one end of the conductor runs to the other, I used the following method. I connected one terminal of a battery to ground and the other terminal to one of the conductors as shown. Between the conductors I connected incandescent lamps, grounding the last conductor as shown. I then went to the other end of the conductor run and connected one terminal of a suitable voltmeter to a nearby water pipe, thus grounding the terminal. To the other terminal of the voltmeter I attached a wire. This wire I touched to all conductors in succession, tagging each conductor with a piece of paper giving the voltmeter reading obtained upon touching the wire to the conductor. The conductor that gave the highest voltmeter reading I knew to be conductor *A*, the one giving the next highest reading, *B*, the next *C*, and so on until I had identified each wire.

M. G. Austin.



Method of Identifying Wires.

Among the Contractors.

B. J. Bingham and O. A. Carlson, of Helena, Mont., both expert electricians and widely known young Helena men, have formed a partnership to engage in the electrical contracting business in Helena at 101 Broadway. The firm is equipped to do any kind of electrical work, and in addition makes a specialty of electrical fixtures for private residences, business blocks and public buildings.

The A. L. Swanson Electric Company, Evansville, Ind., had the contract for installing complete electric cooking apparatus in the recently completed Young Men's Christian Association's building in that town.

The commissioners of Allegheny County awarded a contract for electric fans for the ventilating system of the county court house at Pittsburgh, Pa., to the Franklin Electric Company, of that city.

LETTER TO THE EDITOR.

Electrical Inspection in Detroit.

To the Editor:

In your article entitled "Municipal Electrical Inspection," printed in September 19 issue, I note the adequacy of inspections in Detroit is questioned, owing to the average number of inspections made by each inspector per day. This may, as you state, seem hard to understand, but only by those who are not thoroughly familiar with municipal inspection.

As a rule the inspections made by the municipal inspectors are compulsory by ordinance, and in some cities, as in Detroit, applications are required for the inspection of fixtures as well as wiring.

In many instances inspection calls are of very short duration owing to repairs being made on condemns, to give temporary light, and inspections on sections of buildings in course of construction.

The above stated cases are entitled to be considered an inspection call as an inspection must be made at each call.

The Public Lighting Commission of Detroit employs as inspectors only men who have had several years of general electrical experience, and who are trained to quickly note defects in construction; and when you consider that a municipal inspector is always looking for a life hazard, as well as a fire hazard, you can well understand that said inspectors must be experts in order to properly qualify as inspectors.

Furthermore, the inspectors of Detroit are inspecting continually seven hours each day, and each one has a specified district to cover each day and it provided fast transportation.

In conclusion, I beg to state that the quality of electrical work in Detroit will compare with any and surpass a great many cities in the country, this from my personal observation, and I do not think the writer of the aforesaid article was properly informed on the subject, or the adequacy or efficiency of the Inspection Department of Detroit would not be doubted.

Ben W. Clark.

Detroit, Mich., October 7, 1914.

Outing of Wilkes-Barre Contractors.

The Electrical Contractors' Association of Wilkes-Barre, Pa., recently had an all-day outing at Sauer's Farm, Hanover Township, to which they invited the fellow contractors in the Lackawanna and Wyoming valleys. Baseball and other sports were indulged in and contests held. It has been planned to hold such meetings twice a year.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

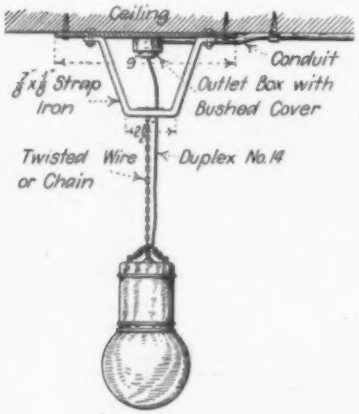
A Fishing Device.

While fishing a run of conduit I had a hard time getting my fish tape through the pipe. I finally took a piece of No. 14 iron wire and pushed it in from the other end of the conduit run. The end of this wire that I pushed into the conduit I twisted into the shape of a corkscrew. By turning the wire like a screw I was able to twist it about the tape and pull it through.

Earl Haskins.

Support for Arc Lamps.

The accompanying illustration shows



Arc-Lamp Support.

the details of the brackets which I used in a large printing plant for supporting arc lamps. There is no strain on the outlet box and the bracket can easily carry a load of from 180 to 200 pounds. These brackets I painted black, which gave a pleasing effect against the white ceiling.

George E. Taylor.

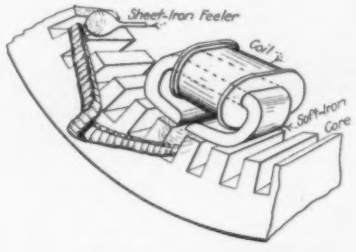
A Novel Fishing Means.

I once had occasion to fish a circuit under a hardwood floor. I made pockets in the baseboard but, because of bridging and other obstructions, I could not get a fishing steel across. I solved the problem by going to the kitchen and borrowing a piece of string and the pet cat. I tied the string to the cat's tail and put her in the hole at one side and closed that end with a piece of board. I then went to the other side with a candle, and in a minute kitty came out bringing the string behind her. It was then easy to pull through a flexible steel-armored cable.

George I. James.

Coil for Short-Circuit Test on Induction Motors.

In the Questions and Answers department of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, for August 29, a method of testing induction-motor coils for short-circuit is described which involves the use of the test coil shown in the illustration. However, no data on the size of the coil is given. It will be found that where a 500-volt source of alternating-current is available for supplying energy to the test coil, that the soft iron core of this coil should have a section of 8x2.5 inches. The coil should be one-half inch in depth, four inches long and wound with 45 turns of No. 5 B. & S. gauge insulated copper wire in two layers. For other voltages it will be necessary to change the size of the wire or the number of turns or both to keep the flux the same



Coil for Short-Circuit Test.

and to prevent heating on high voltages.

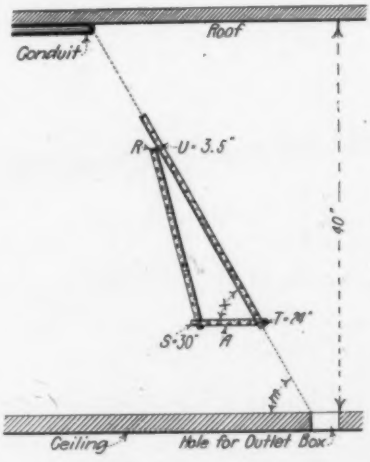
H. E. Weightman.

Determining Bend to be Made in Conduit.

I was recently called upon to run several feet of conduit in a building with a suspended metal-lath ceiling on the top floor. The outlet boxes and conduit could, of course, be pushed up through the holes cut for the outlet boxes, but as there was only 40 inches clearance between the roof and the ceiling and as the manhole was located at one end of the building, the time lost in crawling back and forth to make bends which could not be seen or judged by the helper working on the floor was enormous. It was, therefore, necessary to devise some scheme whereby the time required for the work could be reduced.

A 48-inch or longer folding rule was used. Such a rule was first folded back on itself and one end pointed to an outlet box opening and the other end pointed to the free end of the conduit run to which the box was to be connected as shown by the long side of the rule in the figure. The distance the rule is held from the conduit end or the opening for the outlet box does not matter, all that is required being that one end of the rule points to the conduit end and the other to the outlet box opening in the ceiling.

Keeping one-half of the rule in this position, the man in the attic space folded the other half so as to complete a triangle as shown by the other portions of the rule. One side of this triangle *A* he took pains to keep parallel to the ceiling. In this way the angle *X*, which is the same in value as angle *M*, is determined. Angle *M* determines the bend required. The man in the attic then told his helper on the floor below how the rule was folded. Thus assuming that *R* is the 48-inch point of the rule, he would call to his helper 3.5—24—30, that is, the readings at



Method of Using Rule.

points *U*, *T* and *S*. The helper, taking a similar rule, straightened it out, bent it at the 24-inch division, again at the 30-inch division and brought the other end *R* to the 3.5-inch division. An exact duplicate of the position of the rule held by the man in the attic was thus obtained.

This gives the helper on the floor below the necessary data for making the bend as he knows the angle *M* and the distance between the ceiling and the roof. The conduit was hence bent by the helper and a coupling loosely screwed on, the whole then being inserted through the outlet box hole to the man in the attic.

C. B. Hutchison.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The Union Home Telephone and Telegraph Company was authorized to issue $22,700 of promissory notes to be used in refunding other notes outstanding.

The Consolidated Securities Company was granted authority to sell its telephone system in the city of San Fernando, Los Angeles County, to the San Fernando Telephone and Telegraph Company, and to accept in return a promissory note, issued by the latter company, for $20,000 bearing interest at six per cent per annum, the principal payable in installments over a period of 20 years.

The telephone company is also authorized to issue $10,000 par value of its capital stock to be sold for not less than par and to be used for additions and betterments to its system.

NEW YORK—Second District.

Consolidation Approved. The Second District Commission approved the consolidation of the New York Central and Hudson River Railroad Company with the Lake Shore and Michigan Southern Railway Company, and other railroads controlled through stock ownerships by one or the other of the two lines, into the single corporation, the New York Central Railroad Company. The opposition to the consolidation urged that a permanent system of financing created by the consolidation was not desirable, in that it would make more difficult the possible future disassociation of the properties involved. The Commission, commenting upon this contention, points out the possible advantages to be gained by the consolidation and says: "This Commission is not impressed with the impending danger of a 'permanent system of financing' which may attend approval of the consolidation; rather are we impressed with the petitioners' 'sublime audacity of faith' in creating such lofty ideals and cherishing so magnificent a hope as are embodied in a permanent system of financing for a trunk line railroad. We are inclined to believe that a corporate management which can assuredly usher in that heretofore unheard of—if not undreamed-of—accomplishment in the realm of railroad financing deserves every proper encouragement in its efforts to attain that which would perforce merit general approbation. And, finally, we concur in the opinion of the Interstate Commerce Commission that from the standpoint of economy and operation and facility in financing the proposed consolidation is warranted. The statutory formalities prerequisite to the authorization of the proposed consolidation have been complied with; and there is proof, and the Commission is of the opinion and finds, that the operation of the consolidated properties and the financing of the same under a single corporate entity would through certain incidental economies and facilities in administration, both physical and financial, insure to the advantage of the owners of the enterprise, and presumably to that of the general public as well."

The question arose as to whether or not an increase in the interest rate constitutes a violation of Section 141 of the railroad law which prohibits the issue of "additional securities in connection" or "in consideration for" consolidation. It is the opinion of the Commission that the intent of the prohibition contained in Section 141 is to prevent what may be termed "capitalizing the consolidation agreement." It finds the language of the act clear on this in respect to stock issue where the prohibition manifestly has reference only to the amount of stock and holds that the same intent must be imputed to the language with regard to bond issues, though that language is somewhat less definite. The Commission points out that if this clause were to be interpreted as argued by the objectors to the consolidation it would effectually prevent the issue of all refunding bonds in consolidation proceedings. It finds in the statute no prohibition against the increase in interest rate to induce bondholders to consent to consolidate, the reason for the increase in interest rate in this case. The contention that the consolidation is in violation of the Sherman act and the New York State anti-trust act is also considered. The Commission approves the plan of capitalization and finds that the consolidation is legal.

OHIO.

Bucyrus Light and Power Company. The Commission has announced the rates to be charged for electric service of the Bucyrus Company. This case has been before the Commission for more than a year and the valuation of the plant to be used as a basis for rate making was determined by the Commission in a decision dated May 15, 1914. (Reported in ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of May 30, 1914.)

The Commission finds that company's rates were excessive and that the company's schedule and also the rates prescribed in the city's ordinance were unscientific and unbusinesslike. The rates prescribed in the Commission's order are 15 per cent lower than rates formerly charged and slightly higher than those fixed by the ordinance of the City Council. The company is charged with inefficient management of the plant resulting in furnishing but 50 per cent of its possible service to customers although running at full capacity. The Commission says that under present conditions the rate of return upon the investment would not reach 6 per cent. The rates fixed by the Commission are: For residence and commercial lighting, 10 cents per kilowatt-hour net for 30 kilowatt-hours and under; 7 cents net for the next 30 hours and 3 cents net for all over 60 hours. For sign and window lighting the rate is 7 cents; for power from 5.85 scaled down to 2.16 cents, according to the amount consumed during the time used.

WISCONSIN.

The United Heat, Light and Power Company has entered into an agreement with the village of Sharon for the taking over of its plant by the municipality. The Commission, in determining the proper compensation to be paid by the municipality, finds that the company was liberal in its proposition and that the city secured a good bargain. The agreement between the city and the company was approved by the Commission.

The St. Croix Telephone Company made application for permission to extend its service in the towns of Cylon and Emerald. The Commission found that the proposed extension involved duplication of lines and that the desired service could be obtained through physical connection. The Commission implies its readiness to establish such interchange of service were the proper proceedings instituted.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 240.—Life of Gas-Filled Tungsten Lamps.—What is the longest life record as yet attained on test or in service with the new nitrogen-filled tungsten lamps?—P. C. U., Springfield, O.

No. 241.—Electricians in Mexico.—Do any of your readers know what are the prospects for an electrician in Mexico, assuming that country to have settled down to a state of peace and industrial development?—N. D. G., Oklahoma City, Okla.

No. 243.—Polyphase Rectifier.—Is it possible to change a polyphase 60-cycle current into a direct current for series arc lighting by means of a mercury-arc rectifier without unbalancing the phases? If this is possible, how is the rectifier built and connected?—P. J. T., Dubuque, Iowa.

No. 244.—Shock from Ground Connection.—I have just heard of a peculiar case of shock, which I should like to have explained. The wiring in a building was on three-wire system with neutral well grounded onto the water pipes of house. No shock was noticeable in basement or elsewhere in house, but when standing near to and touching a fire hydrant in front of house a shock could be distinctly felt; it was not serious, but attracted children passing by. What caused this?—W. S. C., Chattanooga, Tenn.

No. 246.—High-Frequency Insulation Tests.—I notice the statement frequently made of late that tests of insulators at high frequency are more dependable than those at the operating frequency of the circuit, such as 25 or 60 cycles, on which the insulators are to be used. What is the basis of this assertion? Is it verified by actual experience?—S. B., Joliet, Ill.

No. 247.—Phase Transformation.—Is is possible to statically (that is, by a device having no mechanical moving parts) change three-phase current into one single-phase current without unbalancing the phases? If this is possible, how is the device constructed for accomplishing the same? What is its efficiency? Is this method being commercially used?—H. D., Detroit, Mich.

Answers.

No. 235.—Size of Rotary Converters.—What limits the size or capacity for which a rotary converter can be built? I understand that certain railways would like to use sizes larger than the manufacturers can furnish.—C. A. Washington, D. C.

For rotary converters the peripheral speed of the commutator is equal to the distance in feet between any two neutral points on the commutator multiplied by the alternations per minute; thus in a 60-cycle machine with six inches between neutral points on commutator, peripheral speed is 7,200 (the alternations per minute) times ½ or 3,600 feet per minute. In the early days of rotary-converter construction a commutator speed of 3,600 feet was prohibitive, and a distance of six inches between neutral points was scarcely possible, inasmuch as with a distance of six inches on a 600-volt machine the commutator bars would have to be too small for safety, as there should be about 40 bars in this space for satisfactory operation. The only way to obviate the difficulty was to increase the peripheral speed of the commutator, and in the modern designs a speed of 6,000 feet is safe, and of course heavier and more bars can be used per pole. They have also introduced improved ventilation and commutating poles, all of which improvements are gradually eliminating the former limiting features in rotary-converter design.—E. J. R., Brooklyn, N. Y.

No. 242.—Extension of Central-Station Lines.—Is there any established rule by state commissions requiring a central-station company to extend its distributing lines to a thinly settled residence district near the city limits where for many years there probably would not be more than an average of one customer per block?—B. M. S., Indianapolis, Ind.

In the matter of requiring extensions of service, commissions have followed a general policy rather than a definite rule and have attempted to decide each case on its merits, with due consideration to the three parties in interest—the company, the present customers of the company, and the party desiring the extension. The company is entitled to a reasonable return on the money invested. Therefore it is largely a matter to be settled between the present customers and those desiring service. If unprofitable extensions are required, the deficit will be made up at the expense of the other consumers.

The New York Public Service Commission, Second District, says "We do not think it advisable to fix any definite percentage, but to confine ourselves to the general rule . . . that where the demand is reasonable the mains should be extended without charge to the consumer, and if the parties cannot agree upon what is reasonable this Commission will determine the fact upon the conditions in any case. Where a canvass of the territory for which service is asked shows a probable gross annual income from private consumers of 20 per cent on the cost of extensions, it should be made free of cost to the consumer. (Simpson, et al., vs. Buffalo Gas Co., P. S. C. R. 2d, Vol II, p. 531.)

The Wisconsin Railroad Commission says that extensions should be put in at the expense of the plant whenever they bid fair to become fairly remunerative. "Because of varying conditions, however, the term 'fair remuneration' may not always stand for like elements. In some cases it may mean the additional cost for the new extensions. In other cases it may stand for something more or something less than this. In most instances, however, it is likely to mean that the gross earnings from the additional consumers should be high enough to place them on about the same footing with reference to the cost of the service as that which obtains from the rest of the consumers of the plant who come in the same rate classes in its regular rate schedules. Wherever these latter conditions prevail, and where under the regular rates of the plant the returns are not unreasonably low, there would also seem to be good reasons why new extensions should be made and paid for by the plant of utility." (Beloit Gas & Electric Co. vs. City of Beloit, 5 W. R. C. R., 617.)

The New Jersey Commission has in a number of cases dismissed applications for extensions of service on the ground that the business on the proposed extension would not provide eight per cent return on the investment.

In the recent decision relating to the rates and service of the Pacific Gas & Electric Company in the San Jose district, the California Commission held that the company should be required to extend its system so as to serve the entire district included within the corporate limits of the city or village in which it had the exclusive right to furnish service and that this ruling might well apply even to the unincorporated territory if the company had clearly undertaken to serve the district. The order in this case in effect requires the company to make extensions upon request and the burden is on the company of showing why, in any instance, this requirement is unreasonable.

The standards of gas and electric service adopted by the Illinois Commission contain a definite rule to be followed in the matter of extensions of service and the rule applying to electric utilities is quoted in full in the last issue of the Electrical Review and Western Electrician, page 711.—William J. Norton, Chicago, Ill.

A storage-battery street car line is being installed at Cardenas, Cuba.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 6.

Power may be transmitted to a lamp load from a three-wire source of supply by a two-wire system as shown in Fig. 5 or by a three-wire system as shown in Fig. 6. Given (1) that the lamp load in either case consists of 40 lamps, each taking 50 watts at 112 volts, and connected as shown in Fig. 5 and Fig. 6; (2) that

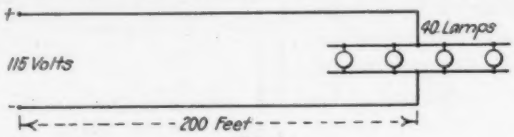


Fig. 5.

the voltage between the line wires in the two-wire system and the voltage between either outside wire and the neutral of the three-wire system equals 115 volts and is maintained constant; (3) that the distance of the lamp load from the three-wire source of supply is 200 feet in either case, and (4) that the power is to be transmitted from the three-wire source of supply to the load at an efficiency of 97 per cent.

Find (*a*) the minimum weight of copper wire required for (1)

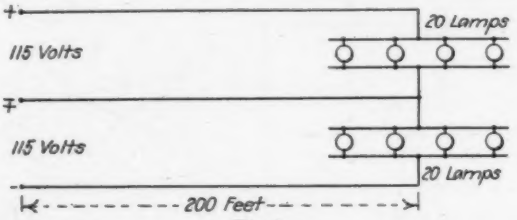


Fig. 6.

the two-wire system; (2) the three-wire system; (*b*) the voltage at the lamps for this minimum weight of copper wire (1) in the two-wire system; (2) in the three-wire system; and (*c*) the ratio of the weight of wire required in the three-wire system to that required in the two-wire system.

SOLUTION OF PROBLEM 6.

The voltage (V_L) at the load in the two-wire system may be determined by [21]

$$0.97=V_L/115$$

and (V_L)=112 volts (approx).

Then since the lamp load indicated in Fig. 5, will take 40×50=2,000 watts at 112 volts, the line current (I_e) is given by [19]

$$2{,}000=112I_e$$

and (I_e) equals 17.9 amperes.

The resistance voltage (V_R) in one line wire (Fig. 5) is thus given by [5]

$$115=112+2V_R$$

and (V_R) equals 1.5 volts.

The resistance (R_e) of one line wire (Fig. 5) is given by [4]

$$1.5=17.9\times R_e$$

and (R_e) equals 0.0838 ohm.

From the wire table, it is found that 200 feet of No. 6 wire has a resistance of 0.403/5=0.0806 ohm.

Since the resistance of 200 feet of No. 8 wire is greater than 0.0838 ohm, a No. 6 wire must be selected for the conductors shown in Fig. 5, since it has the proper resistance and carrying capacity.

Answer to Question a1.

The weight (G) of the two conductors shown in Fig. 5 is thus obtained by [15] or better from the wire table. A No. 6 wire weighs 79.5 pounds per 1,000 feet. Hence 400 feet of No. 6 wire weighs 0.4×79.5=31.8 pounds.

The voltage (V_L) at each lamp load in the three-wire system may be determined by [21]

$$0.97=2V_L/230$$

and (V_L)=112 volts (approx.) as before.

Since each lamp load indicated in Fig. 6, will take 20×50=1,000 watts, at 112 volts, the line current (I_e) is given by [19]

$$1{,}000=112I_e$$

and I_e=8.9 amperes.

Since the two lamp loads (Fig. 6) are equal, no current will flow in the neutral wire and the resistance voltage in the neutral wire is zero.

The resistance voltage (V_R) in one outside wire (Fig. 6) is then given by [5]

$$230=2\times112+2V_R$$

and (V_R) equals 3 volts.

The resistance (R_e) of one outside wire (Fig. 6) is given by [4]

$$3=8.9\times R_e$$

and (R_e) equals 0.336 ohm.

From the wire table, it is found that 200 feet of No. 12 wire has a resistance of 1.62/5=0.324 ohm.

Since the resistance of 200 feet of No. 14 wire is greater than 0.336 ohm, a No. 12 wire must be selected for the conductors shown in Fig. 5, since it has the proper resistance and carrying capacity. The neutral wire, according to the National Electrical Code, must be of the same size as the outside conductors.

Answer to Question a2.

The weight (G) of the three conductors shown in Fig. 6 is thus given by [15] or better from the wire table. A No. 12 wire weighs 19.8 pounds per 1,000 feet. Hence 600 feet of No. 12 wire weighs 0.6×19.8=11.9 pounds.

Answer to Question b1.

The voltage (V_L) at the lamps in Fig. 5 is given by [5]

$$115=V_L+0.0806\times17.9$$

and (V_L) equals 112.1 volts.

Answer to Question b2.

The voltage (V_L) at each group of lamps in Fig. 6 is given by [5]

$$230=2V_L+0.324\times2\times8.9$$

and (V_L) equals 112.1 volts.

Answer to Question c.

The ratio of the weights of wire required for the two systems equals

$$11.9/31.8=37.4 \text{ per cent.}$$

That is, the three-wire system having the same voltage at the lamps, the same lamp load, the same distance of load from source of supply and the same efficiency of transmission, requires only 37.4 per cent of the weight of copper required for the two-wire system. It is to be noted that the ratio (37.4 per cent) is not constant for all cases. In some instances a wire must be selected for either system which is larger than that actually required because of the necessary choice of a standard size. It should be noted that while the two-wire system requires more copper than a three-wire system, its insulation, switches, fuses, etc., are cheaper; it is simpler and its lamp voltage is less liable to fluctuate as lamps are turned on.

ALTERNATING CURRENTS.

Problem 56, Part I.

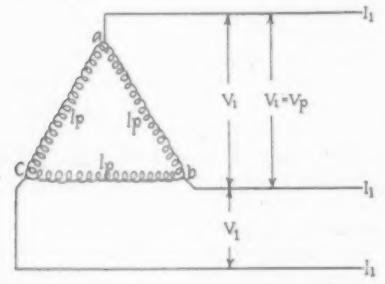
Three similar single-phase motors, each of which takes 20 kilowatts at 0.91 power-factor, are connected in delta across the mains of a 220-volt, three-phase circuit. (*a*) What is the total power supplied? (*b*) What is the line current? (*c*) What is the phase displacement of the line current and the current taken by a motor?

Part II.

Three similar single-phase motors, each of which takes 20 kilowatts at 0.91 power factor, are connected in Y between the mains and neutral conductor of a 220-volt, three-phase circuit. (*d*) What is the total power supplied? (*e*) What is the voltage across each motor, if these voltages are equal? (*f*) What is the phase displacement of the line voltage and the voltage across a motor? (*g*) What is the current in the neutral conductor? (*h*) Compare the equivalent resistance and reactance of each motor load in parts I and II.

SOLUTION OF PROBLEM 56, PART I.

Three-phase loads or three-phase apparatus may have their circuits connected either in delta (Δ) or in Y, as shown in Fig. 7a.



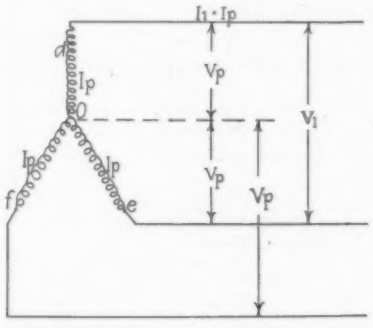


Fig. 7a.—Delta and Star Connections.

In this figure I_p and I_l represent the currents in the phase and in the line conductors. Likewise V_p and V_l represent the voltages across the terminals of a phase and between the line conductors. For the delta (Δ) connection, the phase voltage and the line voltage are the same, while for the Y connection the phase current and the line current are the same. Unless otherwise stated it is assumed that the line voltages of a three-phase circuit are equal; that is, they are equal in voltage value, but are displaced in phase by 120 degrees. Likewise in a *balanced* three-phase load the line currents are equal in ampere value but are displaced in phase by 120 degrees. In Fig. 8a the curves (1), (2) and (3) may be used to represent the currents in the Δ (see Fig. 7a) flowing from *a* to *b*, from *b* to *c* and from *c* to *a* respectively. These curves have a phase displacement of 120 degrees. At the time (t_1) when the current in the first branch has its greatest value and flows from *a* to *b*, the currents in the other two circuits are one-half as great and flow from *c* to *b* and from *a* to *c* respectively. A quarter of a cycle later (at t_2) the current in the branch *a b* is zero, and the currents in the other two branches are 86 per cent of their greatest value and in the second branch the current is now flowing from *b* to *c*, while in the third branch it is still flowing from *a* to *c*. Similar curves can be drawn to represent the line voltages acting to send currents through the three branches or phases.

The common way of representing the currents and voltages is by vectors, as in Fig. 9a.

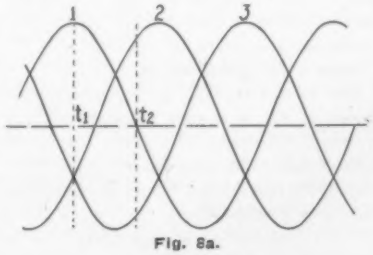


Fig. 8a.

The vectors I_{ab}, I_{bc} and I_{ca} represent the currents in the branches flowing from *a* to *b*, from *b* to *c* and from *c* to *a* respectively. That is, the vectors represent the same currents as did the curves in Fig. 8. The corresponding vectors V_{ab}, V_{bc} and V_{ca} represent the voltages acting to send currents through the branches from *a* to *b*, from *b* to *c* and from *c* to *a*. The angle (θ) is the phase displacement of the current and voltage in any one phase. When the load is balanced the angle (θ) is the same for all of the phases.

Answer to Question a.

The total power supplied to any load which is connected in Δ is equal to the sum of the powers taken by each phase. In this case the load is balanced so that the total power (P) is three times that taken by one phase

$$P = 3 \times 20.$$
$$= 60 \text{ kilowatts.}$$

Answer to Question b.

The current flowing out of the terminal *b* to the line is equal to the current that flows into *b* from *a* less the current that flows away from *b* toward *c*. That is the current flowing out of *b* to the line is equal to the difference of the vectors representing the currents flowing from *a* to *b* and from *b* to *c*. The *sum* of two vectors is found by completing the parallelogram of which they are the sides. In Fig. 10, the sum of *A* and *B* is *C*.

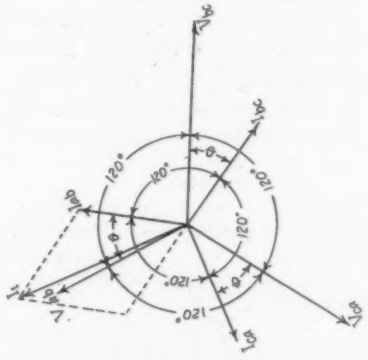


Fig. 9a.

In order to find the difference of two vectors reverse the direction of the one which is to be subtracted and proceed as in the addition of two vectors. In Fig. 10 the difference of *A* and *B* is *D*.

In Fig. 9 the difference of the currents flowing from *a* to *b* and from *b* to *c* is equal to I_l. The sum of two equal vectors which are 60 degrees apart is equal to the √3 times either.

[29a] $I_l = \sqrt{3}\ I_p$

I_l = Line current.

I_p = Phase current.

By (1a) $I_p = 20{,}000/220 \times 0.91$,

$= 100$ amperes,

$I_l = \sqrt{3} \times 100$,

$= 173$ amperes.

Answer to Question c.

The phase displacement between the resultant of two equal vectors which differ in phase by 60 degrees and either of

them is equal to 30 degrees. Therefore the phase displacement of the current in any phase and the corresponding line current is 30 degrees. Observe that at unit power factor, when the angle θ is zero, there is a phase displacement of 30 degrees between the line current and the line voltage.

SOLUTION OF PART II.

Answer to Question d.

The total power supplied to any load which is connected in Y is equal to the

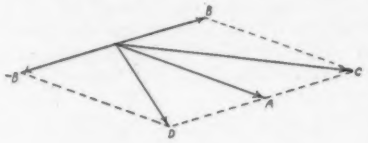


Fig. 10a.

sum of the powers taken by each phase. In this case the load is balanced so that the total power (P) is three times that taken by one phase.

$$P = 3 \times 20$$
$$= 60 \text{ kilowatts.}$$

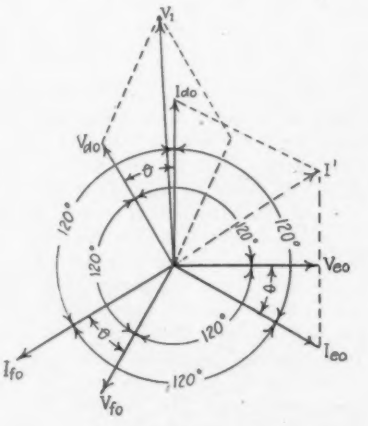


Fig. 11a.

Answer to Question e.

In Fig. 7 (Y connection) the point (O) where the phases meet is called the neutral point. In Fig. 8 the curves (1), (2) and (3) may be used to represent the currents in the three branches flowing *toward* the neutral point (O). At the time (t_1) when the current in the first branch has its greatest value and is flowing from d toward O, the currents in the other two circuits are one-half as great and flow from O toward e and from O toward f respectively. At a quarter of a cycle later (at t_2) the current in the first branch (dO) is zero, and the currents in the other two branches are 86 per cent of their greatest value, and in the second branch the current now flows from e to O, while in the third branch it still flows from O to f. Similar curves can be drawn to represent the voltages between the lines and neutral point which are acting to send the currents through the phases.

The common way of representing the currents and voltages in this circuit is by vectors, as shown in Fig. 11.

The vectors I_{do}, I_{eo} and I_{fo} represent the currents in the three phases flowing toward the neutral point O. The corresponding vectors V_{do}, V_{eo} and V_{fo} represent the voltages acting to send these currents through the phases from the lines toward the neutral point. The angle (θ) is the phase displacement of the current and voltage in any one phase. When the load is balanced the angle (θ) is the same for all of the phases. In order to find the voltage acting between the line terminals d and f consider the

DIRECT CURRENTS.

Problem 7.

A 10-horse-power, 230-volt shunt motor is to be connected to a switch-board 400 feet away as shown in Fig. 7. The voltage at the switch-board is maintained constant at 230 volts. The motor takes 36 amperes at full load and 2.5 amperes at no load.

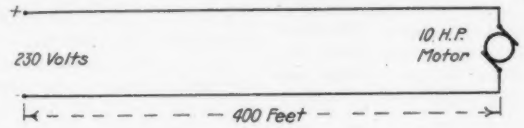


Fig. 7.

Find (a) the proper size of wire to be installed so that the power loss in the line wires will not exceed three per cent of the total power supplied from the switch-board at full load; (b) the cost of the rubber-insulated wire at a base price of 16 cents per pound; the voltage at the motor terminals (c) at full load, and (d) at no load.

ALTERNATING CURRENTS.

This problem illustrates the method of selecting a conductor of proper size to fulfill certain conditions imposed upon a circuit.

Problem 57, Part I.

Three air-core reactors, each of which has a resistance of 5 ohms and a reactance of 2 ohms at 60 cycles, are connected in delta across the mains of a 220-volt, 60-cycle circuit. (a) What is the line current? (b) What is the total power supplied? (c) If *one* of the mains is disconnected what are the total equivalent resistance and reactance of the resulting single-phase load? (d) What are the resistance and reactance of a single reactor which will take the same power at the same power-factor from a 220-volt circuit as do the three reactors when connected in delta across the 220-volt, three-phase circuit?

Part II.

Three air-core reactors, each of which has a resistance of 5 ohms and a reactance of 2 ohms at 60 cycles, are connected in Y across the mains of a 220-volt, 60-cycle circuit. (e) What is the line current? (f) What is the total power supplied? (g) If *one* of the mains is disconnected what is the total equivalent resistance and reactance of the resulting single-phase load? (h) What are the resistance and reactance of a single reactor that will take the same power at the same power-factor from a 220-volt circuit as do the three reactors when connected in Y across the 220-volt, three-phase circuit?

This problem illustrates the relations which exist between the three-phase circuit and its equivalent single-phase circuit.

Solutions of the above problems and two new problems will be printed in the next issue.

phases dO and fO. The voltages V_{do} and V_{fo} are acting to send current toward the neutral point (O) and thus tend to produce currents in opposite directions through the circuit from d to f. The resultant voltage acting to send current from d to f is thus the vector difference of V_{do} and V_{fo} and is V_1. The sum of two equal vectors which are 60 degrees apart is equal to the $\sqrt{3}$ times either.

[30a] $V_1 = \sqrt{3}\ V_p$

V_1 = Line voltage.

V_p = Phase voltage.

$V_p = 220/\sqrt{3}$

$= 127$ volts.

Answer to Question f.

Since the phase displacement between the resultant of two equal vectors which differ in phase by 60 degrees and either of them is 30 degrees the phase displacement between the line voltage and the corresponding phase voltage with Y connection is 30 degrees.

Answer to Question g.

The current flowing in the neutral conductor away from the neutral point (O) is equal to the sum of the currents in the three phases flowing toward that point. That is, it is the sum of the currents, I_{do}, I_{eo} and I_{fo}. The sum of two equal vectors which differ in phase by 120 degrees is equal to each and lies half way between them. For example, the sum of I_{do} and I_{eo} is I^1 (see Fig. 11). This current is equal and opposite in phase to I_{fo}, so that the sum of the two is zero. The sum of three equal vectors which differ in phase by 120 degrees is always zero. Therefore if the line currents in a Y-connected circuit are equal the current in the neutral conductor is zero.

Answer to Question h.

Let R, X and Z with the subscripts 1 and 2 represent the equivalent resistance, reactance and impedance of each motor load in parts I and II respectively.

By [4a] $R_1 = 20{,}000/100^2$,

$= 2.0$ ohms.

By [3a] $Z_1 = 220/100$,

$= 2.2$ ohms.

By [5a] $X_1 = 0.92$ ohm.

Likewise: $R_2 = 20{,}000/173^2$,

$= 0.67$ ohm.

Since $I_2 = 20{,}000/127 \times 0.91$

$= 173$ amperes,

$Z_2 = 127/173$,

$= 0.73$ ohm.

$X_2 = 0.31$ ohm.

The general relation is this:

[31a] If two three-phase circuits take the same power at the same power-factor the equivalent resistance and reactance of each phase of the one which is Δ-connected are three times as great as the corresponding constants of the one which is Y-connected.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Meetings in New York and Philadelphia—International Electrical Congress Postponed—Protective Reactors — Submarine Signaling — Electrical Equipment of Battleship—Reclamation Service.

The 299th meeting of the American Institute of Electrical Engineers was held at the Engineering Societies Building, New York City, on Friday evening, October 9, with President Paul M. Lincoln in the chair.

Secretary Hutchinson announced that at the meeting of the Board of Directors, held the same afternoon, resolutions were adopted postponing indefinitely the International Electrical Congress, which was to have been held in San Francisco next September. This confirms the action of the Executive Committee of the Congress, already announced. Subscriptions for membership in the Congress will be refunded in full. It is probable that the Institute will arrange for a meeting in San Francisco next year, in either June or September.

Two papers were presented at this meeting. The first, by James Lyman, Leslie L. Perry, and A. M. Rossman, entitled "Protective Reactances for Feeder Circuits of Large City Power Systems," was abstracted by A. S. McAllister.

The second paper was by J. L. McK. Yardley, and was entitled "Use of Reactance with Synchronous Converters: An Insurance to Continuity of Service and a Protection to Apparatus."

Protective Reactors for Feeder Circuits.

This paper outlines the use and limitations of protective reactance coils in feeder circuits. When no feeder reactors are used, doubling the station capacity increases the number and severity of short-circuits. The insertion of feeder reactors cuts down the severity of a short-circuit and renders the effect local, so that beyond a certain point additional generator capacity does not appreciably increase the severity. Bus section reactors in the generating station in connection with feeder reactors still further reduce and localize the effects. Curves are given showing what the effects of feeder reactors are, with and without bus reactors, for generators of various reactances. The advantages that might be gained by parallel operation of feeders are discussed and the difficulties to be encountered are pointed out.

Use of Reactors with Synchronous Converters.

The paper presents the results of overload and short-circuit tests made several years ago upon some synchronous converters in circuit with auxiliary reactors. Two entirely separate sets of tests upon two synchronous converters of widely different operating characteristics are described. In the one case the reactor is in the alternating-current circuit and in the other in the direct-current circuit; yet in each it may be called, and in fact is, a protective reactor. The author has divided synchronous-converter installations in a general way into classes with respect to the need or desirability of employing protective reactors, and also with respect to the general design or type of the reactor to be employed. In order to do this synchronous-converter installations are divided with respect to the character and exactions of the service conditions under which they are required to operate.

The discussion was opened by D. B. Rushmore, who pointed out the change in point of view regarding reactance. Formerly it was kept as low as possible for the sake of regulation. Now it is frequently specified that transformers must have a reactance of 6 to 8 per cent. Where more reactance is required than fits the design of the machinery to meet other conditions, external reactance is added. Two effects of heavy currents must be considered: one is the force exerted upon the conductor, and the other is the heating effect. We need a method by which the reactance may be low until the current exceeds a certain value, and then automatically rises to a high value.

Philip Torchio pointed out that the effect of a given inductance depends upon the frequency of the generator. The energy lost, due to feeder reactance, amounts to less than 0.1 per cent of the transmitted power at 60 cycles, and less than 0.2 per cent at 25 cycles for a reactance of 3.5 per cent. Reactance not only limits the short-circuit current, but prevents the bus voltage from dropping. The New York lighting companies were pioneers in the use of feeder reactors for station auxiliaries. He showed lantern slides of the equipment of the 201st Street station of the United Electric Light and Power Company. Mr. Torchio favored insulated windings for reactors.

H. W. Buck told of several instances of destructive action in power houses, due to short-circuits. Reactors are not needed in long-distance transmission systems since the line itself has sufficient reactance.

R. H. Somers pointed out that on direct-current systems the whole network is connected in multiple, and short-circuits seldom cause the shutdown of synchronous converters. Alternating-current systems are tending toward the same condition, but at present feeders are radially connected. Trouble results when they are interconnected. The use of reactors and relays will soon make interconnection possible. He pointed out the dangerous feature of insulation on reactors, since it provides a large amount of in-

flammable material at a point where it is exposed to great heat.

N. W. Storer pointed out that reactance could be had in a circuit when desired by shunting the reactor with a quick-acting circuit-breaker.

C. J. Fechheimer pointed out the objection to iron in reactance coils, as the saturation of the iron prevents proportionality of reactance to current. The current flowing on short-circuit depends somewhat upon the point of the wave at which short-circuit occurs. This makes it difficult to determine the short-circuit current. He also pointed out that in large generators high reactance is obtained by using a large number of turns. The most economical machine, however, is not always the one with the largest number of turns.

J. L. Burnham gave some results of tests similar to those described in Mr. Yardley's paper. These seem to point to the necessity of a quick-acting circuit-breaker. The converter cannot be protected from flashing unless the first current rush is cut down. No reactance on the alternating-current side will prevent flash-over with a dead short-circuit. When a converter was short-circuited immediately after being disconnected from the alternating-current supply, it took about twelve times full-load current and flashed over. With 60 per cent reactance in circuit 21 times full-load current was obtained. He did not agree with Mr. Yardley that the alternating current is at all times approximately proportional to the direct current. During the first few cycles the direct current is always decidedly higher.

The papers were also discussed by Messrs. Frank, Goodwin, Hanchett, Woodward, and Howard.

In replying, Dr. McAllister called attention to the incorrect use of the word "reactance" where "reactor" is meant.

Mr. Yardley, in closing the discussion, said that the circuit-breaker which was used operated in 0.015 second, and by closer adjustment he thought this could be reduced to 0.01 second.

Philadelphia Meeting.

The 300th meeting was called to order at 2:15 p. m., October 12, in the Engineering Building of the University of Pennsylvania, by President Lincoln. In his introductory remarks, Mr. Lincoln called attention to the significance of the figure 3 in this meeting. In addition to its being the 300th meeting of the institute, it was also the 30th anniversary of the organization, which occurred in this same city, almost to the day, 30 years ago.

In the absence of the author, R. F. Blake, and his collaborator, R. H. Fessenden, the paper on "Submarine Signaling" was abstracted by H. J. W. Fay, assistant manager of the Submarine Signal Company, of Boston.

Submarine Signaling.

Submarine signaling has been greatly advanced by the introduction of a powerful sound transmitter and receiver called the "Fessenden telegraph oscillator." By means of this, telegraph messages can be sent and received through the water by moving ships, and for short distances speech can be transmitted, icebergs can be located, and soundings taken instantaneously. The apparatus consists of an oscillating electric motor-generator which has a strong electromagnet surrounding a central core on which is an alternating-current winding. Between the core and the magnet is a copper tube which acts as a closed secondary to the core winding. This copper tube is attached to a large diaphragm. When the alternating current passes through the core winding it induces a current in the copper tube, which, being free to move, vibrates back and forth, thus setting the diaphragm in vibration. This apparatus is installed in a ship so that the face of the diaphragm is in contact with the water and its vibrations set up sound waves in the water. Signals have been sent a distance of 31 miles. The oscillator can also be used as a receiver. Sound waves striking against the diaphragm cause the copper tube to vibrate, thereby generating a current in itself and in the core winding. A telephone receiver in the armature circuit enables the observer to hear the sound.

In the discussion following, W. S. Franklin called attention to experiments and tests by Professor Webster, of Clark University, and others, to determine the energy of sound and asked if such measurements had been made with the signaling apparatus. The current used was 13 amperes at 170 volts and at the receiving station 46 feet away, 0.00004 ampere could be detected.

Elmer A. Sperry remarked on the enormous force it must require to vibrate a diaphragm 0.75 inch thick, of steel, when only 24 inches in diameter. He considered it a most ingenious and remarkable apparatus.

A. S. McAllister read a communicated discussion from John B. Taylor, in which he emphasized some conditions and difficulties which, though not in the paper, were brought out in the discussion. V. Karapetoff made a lucid explanation, using diagrams on the blackboard, pointing out the path of magnetic flux in the armature and windings of the apparatus.

George A. Hoadley suggested that probably a more elastic membrane would accomplish as effective result with less energy.

Others discussing the paper were Messrs. Breed and Woodbridge. Answers to questions brought out that the amplitude of vibration is 0.01 inch. The accuracy of direction can be determined within 1 point or 11 degrees at 3 miles distance. Interference of other sounds and cross currents can not be prevented unless the time difference of vibrations was considerable.

The next paper entitled "Electrical Equipment of the Argentine Battleship *Moreno*," by H. A. Horner, was then abstracted by the author. He called attention to the departure from standard American practice. It took five years to complete, whereas United States ships have averaged about three years. He referred to it as a stupendous undertaking and a marvelous feat of engineering.

Electrical Equipment of the "Moreno."

This paper describes the electrical installation of one of the two Argentine battleships building in this country and now nearing completion. Detailed descriptions are given of important and unusual equipments such as steering gear, anchor windlass, searchlights, gyro-compass, etc. This equipment is the largest and most costly ever installed in this country, comprising 3,000 electric lamps, 4,000 rated horsepower and approximately 76 miles of cable. It is a noteworthy engineering achievement in that it was a departure from American practice in the use of 230 volts; in the employment of lead-covered, steel-armored conductors; in the application of 220-volt tungsten lamps; in the use of electricity for the purpose of steering the vessel, operating the anchor, and the bilge pumps; and many more advances in the application of electrical power.

This paper was discussed by Messrs. Hibbard, Sperry, Day, Pierce, Bier, Lenard, McDowell, Cochran and Porter.

Maxwell W. Day, who had considerable to do with furnishing the equipment, stated that the naval features were largely foreign, German predominating. He commended the use of 220 volts as it saved copper and losses. The asbestos-lumber switchboard was adopted on account of some weaknesses of the slate panel. He also commended the use of alternating current for internal communication. The balancer sets for the searchlights, used on account of requiring lower voltage, showed up well in tests and much was expected of them. He also called attention to the advantage secured from electrically operated anchor winches and lifting apparatus in the turrets. One of the present war vessels had a steam pipe cut by a shot and steam escaped in clouds, but the shooting was not interfered with.

G. H. Pierce, Jr., thought the *Moreno* surpasses anything ever built in this country. The elimination of conduit was a long step in the right direction. The use of armored wire allowed neater work, easier inspection, lighter weight, on 220 volts, and more rapid installation.

Elmer A. Sperry spoke of the difficult problems which had to be solved and explained the difference between

his gyroscopic compass and that of Dr. Anschütz, which was used.

Mr. Hibbard said that the advantages for the electric drive on the windlass were greater torque, reduced power installed and avoidance of losses of steam pipes.

Mr. Cochran made a plea for a continued uniformity in voltage for all purposes. He stated that the pay in the navy for electricians was not sufficient to attract and hold very high-grade men; those who were there are accustomed to 125 volts and if, in an emergency, repairs were needed or jumpers to be hooked in, less opportunity would exist for error. If a variety of voltages were in use, and the 220-volt line should be connected to the signalling system, for instance, the whole signal system might be put out of service with disastrous results.

C. S. McDowell explained further some tests made on the mirrors and parabolic reflectors for searchlights. He also stated that tests for life on 220-volt lamps showed results as good as with 110-volt lamps.

L. C. Porter also endorsed the life qualities of 220-volt tungsten lamps, but said they were not of so good efficiency; the best they can get is 1.6 to 1.3 watts per candle. Also there is some tendency to arc across the terminals in the globe and sometimes the arcing will cause the filament to unite near the supporting hooks and by shortening the filament, reduce the life of the lamp. Their ruggedness and strength are just as good as lamps of lower voltage.

In conclusion, Mr. Horner stated that the wiring was considerably simplified by eliminating the three-wire system of the 110 volts and using 220 volts, two-wire throughout.

In concluding the afternoon session, Chairman H. F. Sanville read a communication from Past President C. O. Mailloux highly commendatory of the Philadelphia Section.

Dinner was served at the Hotel Normandie during which President Paul M. Lincoln made a few appropriate remarks.

At the evening session George A. Hoadley read the paper by F. H. Newell, entitled "Electrical Features of the United States Reclamation Service," author not being present.

Electrical Features of Reclamation Service.

The operations of the United States Reclamation Service are of interest to electrical engineers not only in some of the novel developments and applications of power, but also as illustrating the efforts of the Federal Government in the construction of works of general public utility. One of the most interesting features is the question of cost of government work, much of which in this case is executed under pioneer conditions. These costs are carefully recorded and include all of the overhead or general expenses. These costs show that during 1913, for the various plants there was a range from 0.13 cent per kilowatt-hour to 2.87 cents. The power not needed for construction purposes or for operating irrigation works is being sold at rates of 1.5 cents per kilowatt-hour and for excess power as low as 0.5 cent. For heating the rate charged per month per 1,000 watts is $1.00 in winter. The experience obtained is illustrating the fact that it is practicable for the Government to build and operate plants of this kind and sell the power at cost, in connection with other enterprises and with general satisfaction to the consumer. The power plants will be paid for without profit or interest and the operations transferred as soon as practicable to the communities benefited by them.

The discussion was rather limited, being participated in by Messrs. Spencer, Pope, Kirshner, Hornor, Pender, Goodwin, Hering and Karapetoff.

The latter said he was very glad to hear presented before the Institute a paper which gave such satisfactory reports of the operation of power plants by the United States Government. He was in favor of government ownership and this proved its feasibility. He called attention, however, to the misleading character of the quoted rates per kilowatt-hour. These varied nearly as the load-factor and very different figures would be shown if the amount of business done were greater. He also suggested that probably these plants could be used for electrochemical processes at those times when irrigation was not in demand, especially in the manufacture of nitrogen fertilizers.

It was brought out that the motors used in the West for irrigation pumping were largely for high voltage and considerable transformer loss was avoided. Farmers were used to them and electrocution accidents were rare. The figures given indicate that heating current could be secured for about 0.02 cent per kilowatt-hour if used continuously. This was possible because absolutely no irrigation is needed in winter and the output of the plants is going begging at that season.

The meeting adjourned at 9:45 p. m.

Utah Power Companies to Develop Permanent Exhibit Building.

The Utah Light & Traction Company and the Utah Power & Light Company have joined forces this year in preparing what is pronounced to be the most elaborate exhibit of electrical appliances used in the home and on the farm ever made in the State of Utah. They have erected a permanent building 30 feet by 50 feet on a plot occupying approximately a half acre of ground. In one end of this building is a complete exhibit of power-driven farm machinery; in the other end most every known appliance for making home life pleasurable is shown and its use demonstrated. Outside the building is the larger farm machinery such as hay presses, silo cutters, etc. An electrical cascade intended to illustrate the use of electricity for irrigation pumping purposes is a most attractive feature of the exhibit, particularly at night. Water is elevated by means of an electrically driven centrifugal pump and permitted to run down a shaft over obstructions behind which colored incandescent lamps are located, thus producing a most stiking effect. An electric kitchen is shown in a house apart from the main exhibit and in this the possibilities of the electric range are being demonstrated by Miss Helen L. Bartlett and her assistant, Miss Smith, a different branch of cooking being shown each day. The lot occupied by this special exhibit faces on two main thoroughfares of the grounds and along these two fronts nine special decorative lamp posts are located each mounted with two 750-watt "Type C" Mazda lamps. This brilliant illumination makes the exhibit stand out more prominently than any other on the ground, and attracts many visitors particularly at night. All inquiries made by visitors at the fair for apparatus are referred to the local managers of the various towns from which the inquiries originate and these will be followed up by salesmen as soon as the visitors return to their homes.

Cedar Rapids-Massena Transmission Line.

The 45-mile transmission line to carry 85,000 horsepower of electric power from Cedar Rapids, in the St. Lawrence River, through Cornwall to Massena, N. Y., is expected to be completed by November 1, 1914. There are 321 steel towers, 600 feet apart, 15 feet square at the base and varying in height from 45 to 200 feet. There are about 5,000 pounds of galvanized angle iron in each tower. All this angle iron, costing about $107,000, was purchased from a company in Pittsburgh, Pa. The insulators to the value of $28,500, came from a branch American concern in Hamilton, Ontario. The wire for the cables, value $152,000, is aluminum and is supplied from a branch factory in Quebec of the Aluminum Company of America. Line hardware, costing about $10,000, and about $2,000 worth of wood and steel blocks, also came from the United States.

An auxiliary telephone system for reporting the condition of the transmission line parallels the route; 1,500 telephone poles, value about $17,000, came from Minneapolis. The telephone wire is also of aluminum.

The New York Electrical Exposition and Motor Show.

The annual New York Electrical Exposition and Motor Show was held at the Grand Central Palace from October 7 to October 17. In point of attendance and in number and comprehensiveness of exhibits, the exhibition surpassed those of previous years. The exhibits were well classified and well grouped, and there was evident a general feeling of satisfaction upon the part of both the exhibitors and those in attendance.

The following is a brief summarization of the principal exhibits and their leading characteristics:

Motors and Heavy Apparatus.

Exhibiting electric motors, the Bell Electric Motor Company showed its compensated type of polyphase motor, a recent invention doing away with compensators, automatic transformers and starting coils.

The Century Electric Company had an exhibit devoted entirely to single-phase alternating-current motors and motor-driven fans. Of particular interest was the one-sixth horsepower motor, the smallest of the repulsion-induction kind on the market, and a recent addition to the Century line.

The General Electric Company had a most comprehensive exhibit showing a great variety of apparatus including household devices, automobile accessories, lighting fixtures, lamps and testing apparatus. The company's standard mercury arc rectifier, together with charging panel and battery-charging rheostats attracted attention in the electric garage and automobile track exhibit.

The Hamilton-Beach Manufacturing Company had an interesting line of fractional horsepower motors, including vibrators, electric grinders, drink mixers, hair dryers, shoe dryers and household and office fans.

The Kinetic Engineering Company exhibited its organ blower in operation. This motor-driven blower is of the centrifugal noiseless type.

An interesting motor exhibit was that of the Twinvolute Pump and Manufacturing Company demonstrating the motor-driven pump equipment as used in hotels, apartment houses, office buildings and loft buildings.

An elaborate display of electrical apparatus for both home and industrial uses was shown by the Westinghouse Electric & Manufacturing Company. This exhibit included a complete line of motors, heating apparatus, measuring instruments, protective devices and material used in the generation and distribution of electrical energy. The striking feature of the exhibit was the new "Luxsolite" fixture equipped with type "C" Mazda lamp for the illumination of streets and larger exterior areas.

Domestic Appliances.

The C. C. Bohn Electric Company exhibited a complete line of Santo portable and stationary vacuum cleaners. This exhibit also included many novelties in the way of electric irons, stoves, toasters, grills, elevators, radiators, ovens and fans.

The Eureka Sales Company displayed a number of the vacuum cleaners and sweepers for which it is the representative.

The Frantz-Premier Suction Cleaner Company made a picturesque display of its suction cleaner apparatus. A feature of this device is its light weight, being so constructed that there is no effort at all in handling it.

Six models of various sizes of cleaners, including the designs for small apparatus and the big machines for hotels and public buildings, were displayed by the Hoover Suction Sweeper Company.

The Innovation Electric Company displayed its "Magic" and "Liberty" portable vacuum cleaners. The historical exhibit showing the development and progress of the manufacture of vacuum cleaners was particularly interesting.

Other exhibitors of vacuum cleaners were the Universal Vacuum Cleaner Maintenance Company and the Vacuna Sales Company.

Heating and Cooking Apparatus.

The electric bakery, the mechanical equipment of which was furnished by Jaburg Brothers, included the equipment usually installed in a small modern shop, consisting of flour sifter, dough mixer, dough divider, rounder-up, molding machine, troughs and a proofing closet. There were also two electric ovens and a water heater provided by the General Electric Company.

The Hot Point Electric Heating Company made a complete exhibit of heating and cooking devices.

Wells, Mowbray & Newman, Incorporated, exhibited a complete electric kitchen. Visitors partook of the results of the electric cookery. This equipment included a Biltmore bungalow range, complete with side table, hood, ventilating fan, cook's table with chopping block and plate warmer, refrigerator with refrigerating and ice-making plant, dish washer, steam table and instantaneous water heater.

The development of various types of cooking utensils and standardization of electric heating units was well exemplified by the fine exhibit of apparatus manufactured by the Simplex Electric Heating Company shown by Roger Williams, New York representative.

Electric Vehicles.

Three models of the Detroit Electric were exhibited by the Anderson Electric Car Company. These included the cabriolet, the forward-drive five-passenger car and the five-passenger duplex-drive car.

S. R. Bailey & Company exhibited its popular cross-country roadster equipped with Edison battery. This machine has been used to great advantage as an emergency wagon by a number of central stations.

The exhibit of the Electric Vehicle Association of America was particularly interesting, showing charts and curves of actual working conditions with comparative data relating to tests concerning horse and electric vehicle operation, as well as comparisons with gasoline-car service.

The exhibit of the 1,000-pound chassis with worm drive and panel body of the General Vehicle Company attracted a lot of attention. There was also a two-ton delivery vehicle and a demonstration of a two-ton chassis on the auto track.

The New York Electric Vehicle Association directed the demonstrations on the auto track and in the electric garage. On the demonstration track many cars were shown in actual operation. These included the Detroit Electric, Bailey roadster, Ward delivery wagons and General Vehicle trucks. The modern garage built by the Andrew Greis Company, exhibited the latest developments in machinery for the care of electrics.

The Ward Motor Vehicle Company exhibited a small electric delivery wagon designated as the "Ward Special." This is designed to meet the needs of local tradesmen and was shown for the first time.

Storage Batteries.

The Edison Storage Battery Company exhibited various types of the Edison alkaline cell. These ranged from the small cells used in miner's and firemen's safety lamps, to 450-ampere-hour batteries for the equipment of brewery trucks, railway tractors, interurban railway cars and heavy duty of all kinds.

The Electric Storage Battery Company exhibited its central-station type and vehicle-type batteries, including the "Chloride Accumulator" and "Exide." A feature of this exhibit was the 1915 "Exide" starting and lighting equipment, a battery being put through a cycle of operations demonstrating its ability to deliver energy for automobile lighting and for starting the engine.

The Gould Storage Battery Company showed its batteries for the operation of electric trucks and pleasure cars, and for automobile lighting and starting. The larger forms of batteries for

central-station and street-railway operation were also shown.

The Philadelphia Storage Battery Company exhibited various types of storage batteries, including equipment for electric trucks and pleasure cars, lighting and starting batteries and ignition sets.

Electric Illumination.

The Cooper Hewitt Electric Company exhibited the mercury-vapor lamp, quartz lamp, incandescent lamps and photographic outfits. The type "Z" quartz lamp, operating in multiple on a 220-volt, direct-current circuit attracted a great deal of attention. The new Cooper Hewitt method of diffusing light by means of ruled globes was also shown in connection with an exhibit of round-bulb tungsten lamps.

An adjustable light holder for factory use, giving a radius of from one and one-half feet to 20 feet by means of universal joints and friction discs, was displayed by the DeCamp & Sloan Manufacturing Company.

The Lux Manufacturing Company exhibited various types of drawn-wire tungsten lamps ranging from two and one-half watt low-voltage sign lamps to the 1,000-watt nitrogen-filled unit.

The National Lamp Works of the General Electric Company made a very comprehensive display of the latest developments in incandescent lamp manufacture. This included every type of lamp from the baby Mazda no larger than a pea to the big 2,000-candlepower Mazda. The booth contained many instructive exhibits relating to the historical development of the incandescent lamp, as well as statistical data and comparative information relating to the economy of the Mazda incandescent lamp.

Electric Novelties, Wire and Wiring Equipment.

Among the miscellaneous exhibitors were the Art Metal Construction Company demonstrating the desirability of fireproof office furniture and equipment.

The Auto Call Company demonstrated the economy in point of time in eliminating messenger service for interdepartmental work.

An interesting safety-fuse plug was exhibited by Cornelius C. Balassa. This fuse plug is equipped with six fuses so arranged that if one blows another is fitted in place by turning the plug one-sixth way around.

Brushes for every character of electric service, including high-grade carbon brushes, wire-gauze brushes and other specialties of this character were shown by Charles B. Chapin Company, Incorporated.

Indoor electrical advertising was exhibited by Harvey Deschere & Company.

The Electric Products Company exhibited the Wotton electric charging apparatus.

The Dictograph, equipped with a loud-speaking receiver, was displayed by the General Acoustic Company.

A remarkably interesting war-time exhibit of the submarine cable used for mines and torpedoes made up a part of the display of rubber-covered wires by the Habirshaw Wire Company. There was also exhibited some very interesting technical information relating to the various Habirshaw products.

The Home Washing Machine Company exhibited a small portable cleaner arranged to be fastened to a stationary tub and operated from the lamp socket.

McLeod, Ward & Company exhibited a complete line of ornamental lamps, desk fixtures, drop lights, desk brackets, piano lamps, etc.

A complete line of service and meter protective devices and wiring specialties was displayed by the Metropolitan Engineering Company.

One of the most interesting displays was that of the National Carbon Company showing the Columbia cells in their various applications. There was also a historical exhibit of the development of arc lamp carbons, showing the various steps from the old open-arc carbon to the modern solid impregnated carbon for long-burning flaming arcs.

The National Scale Company exhibited its precision scales for weighing material of very small dimensions.

The commercial application of ozone was displayed by the Neel-Armstrong Company. This included various oxidation processes, preserving processes and water sterilizing.

The Northwestern Electric Equipment Company displayed the wiring specialties manufactured by the Metropolitan Engineering Company.

The Pittsburgh Electric Specialties Company exhibited a line of electric heating and cooking devices, including a Helion luminous toaster.

Pratt & Cady Company, Incorporated, exhibited an interesting line of motor-operated engineering equipment.

A new propeller type of fan was a feature of the L. J. Wing Manufacturing Company. This exhibit demonstrated various methods of air handling and there was also an exhibit of power plant machinery made by this company.

The Public Utilities.

The public service corporations in and about New York City made a very effective showing, these exhibits attracting the greatest attention from everyone in attendance.

The Consolidated Telegraph & Electrical Subway Company showed a section of a manhole with a line of ducts leading into it and the various devices which are installed for the transmission and distribution of electrical energy.

The Edison Electric Illuminating Company of Brooklyn demonstrated its easy-payment house-wiring plan, there being five booths which showed the possibilities of this idea. Another booth showed a complete electric kitchen and the other booths were equipped with many devices demonstrating the use of electricity in the modern home.

The New York Edison Company, through its Bureau of Home Economics, exhibited a complete laundry, kitchen and cooking equipment. The exhibit of this company included displays and demonstrations by its Sign Bureau, Advertising Bureau, Educational Bureau, Photographic Bureau, and there were also representations of its students' booth, its Bronx office and its Bureau of Illuminating Engineering.

The New York and Queens Electric Light & Power Company, by means of charts, photographs and maps, illustrated the advantages both as to location and service that the Borough of Queens offers to manufacturers and suburban residents.

The New York Service Company, operating steam-heating plants, made a display of charts and diagrams showing the methods of adopting its service and the growth in its business during the past three years.

The United Electric Light & Power Company made a pictorial exhibit of its generating stations, distribution lines and supply stations, a feature of the exhibit being a working model of the company's new generating station, Two Hundred and First Street and the Harlem River.

The Yonkers Electric Light & Power Company made a demonstration of particular interest to the retail shop keepers.

Electrotherapeutics.

The exhibit of apparatus devoted largely to electrotherapeutics was comprehensive and elicited much favorable comment regarding this comparatively unfamiliar apparatus. The Bureau of Electrotherapeutics of the New York Edison Company arranged an interesting exhibit of electrical appliances showing the equipment designed for use in the office of a general practitioner. Other exhibitors were the Bachelet Medical Apparatus Company, Incorporated, Hanovia Chemical & Manufacturing Company, J. W. Hughes & Company, Neel-Armstrong Company, Prometheus Electric Company, Shelton Electric Company and the American X-Ray Equipment Company.

The Government's Exhibits.

An exhibit that attracted probably as much attention as anything else was the comprehensive display made by the United States Government, including representations from the War Department, United States Navy, the Bureau of Commerce and Labor, and the Treasury Department.

Miscellaneous.

The barber shop, dairy, chicken run, the electric laundry, an electrically-equipped cigarette factory, the ice plant, a representation of the Mohawk barge canal, the electrically-equipped printing office, the restaurant and the candy plant all attracted attention.

The Tucker Agency, Incorporated, made an elaborate display of public service advertising.

The electrical press was represented by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN and *Electrical World*.

The Electrical Testing Laboratories made a display of its laboratory equipment used in testing out electrical engineering apparatus of every description.

The American Electric Railway and Allied Associations.

The thirty-third annual convention of the American Electric Railway Association and its allied and affiliated bodies was held at Atlantic City, N. J., October 12 to 16. The attendance was not as great in number as in former years. The program was interesting and timely and well discussed, but the attendance at each of the various sessions was rather small.

The exhibits were about the same in number as a year ago, although not quite as much floor space was occupied as last year. The reception to the officers of the several associations was held at Young's Pier on Monday evening and the balance of the week was devoted to sessions each morning and afternoon, ending with the meeting of the Engineering Association on Friday morning. President Charles N. Black, vice-president and general manager of the United Railroads of San Francisco, presided at all of the sessions of the American Electric Railway Association.

The exhibits, under the direction of H. G. McConnaughy, were well arranged and included among others those of the following manufacturers: Albert & J. M. Anderson Manufacturing Company, American Steel & Wire Company, The Brookfield Glass Company, Bridgeport Brass Company, Joseph Dixon Crucible Company, Electric Service Supplies Company, General Electric Company, General Railway Signal Company, General Vehicle Company, Incorporated, Hubbard & Company, Independent Lamp & Wire Company, H. W. Johns-Manville Company, Kerite Insulated Wire & Cable Company, Morgan Crucible Company, Limited, National Carbon Company, Naugle Pole & Tie Company, Nungesser Carbon & Battery Company, The Ohio Brass Company, The Okonite Company, Pyrene Manufacturing Company, The Rail Joint Company, Railway & Industrial Engineering Company, John A. Roebling's Sons Company, Speer Carbon Company, Standard Paint Company, Standard Underground Cable Company, The Waclark Wire Company, Western Electric Company, Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company.

Care and Foresight Will Prevent Avoidable Accidents.

In the September 30 issue of the bulletin of the Utilities Mutual Insurance Company, some valuable suggestions are given with regard to the use of care and foresight in preventing avoidable accidents. These suggestions are reproduced herewith:

First—Foreman mistook 2,200-volt alternating current for 500-volt direct current, and in making a test a short circuit occurred, the flash of which burned his hands and arms and affected his eyes.—Suggestion: Foremen should not only trace circuits before making tests, but should wear rubber gloves and goggles when so doing.

Second—Employee with sleeves rolled up gets blood poisoning from scratch by copper wire on bare arm.—Suggestion: Immediate use of the first-aid kit.

Third—While replacing insulators in high-tension transformers employee was burned in palm and back of hand, also wrist.—Suggestion: The current should be shut off in doing work of this kind.

Fourth—Employee in unloading transformer from truck to elevator strained ligaments in back.—Suggestion: A helper for a few minutes would have prevented this accident. Sufficient assistance should be given in moving heavy bodies.

Fifth—Two employees were holding blast pipe which was resting on two planks. Both men let go of the pipe to adjust third plank, which resulted in partial dislocation of ankle joint of one of the employees.—Suggestion: The third plank should have been in place, properly secured, before the work was started.

Limiting Conditions for Use of Electricity in Mining.

At the Australian meeting of the British Association for the Advancement of Science a paper was presented by W. M. Thornton on "The Limiting Conditions for the Safe Use of Electricity in Coal Mining." This was a summary of recent researches on the limits of electrical ignition of inflammable mine gases and coal dust. The lower limit of inflammability is 5.6 per cent of methane in air by volume; a temperature of 220 degrees Centigrade lowers this to 5.1 per cent. The most inflammable mixtures are at 8 per cent for continuous-current break-sparks, 10.2 per cent for alternating-current breaks. Excess of nitrogen appears to markedly increase the necessary igniting current. With non-inductive circuits one ampere at 100 continuous volts is a typical value; the corresponding values with alternating current are 7 amperes at 40 cycles, 16 at 60, 20 at 80, and 29 at 100. By varying the inductance the energy of an igniting break-spark is found to be constant at about 0.1 joule. Electric signaling bells have inductance up to 0.5 henry and ignite gases at the trembler spark, or signaling point. All electric lamps and fuses, however small, must be inclosed. Oscillations on a cable sheath caused by short-circuits on the conductor will not ignite gas, but maintained leakage arcs from armoring are only slightly more active than break-sparks. Static discharges from six-inch high-speed belting could not be made to ignite gas, nor the blue brush discharge from high-pressure conductors. Movements of clouds of dust have been shown to give electrification and to cause sparks, but the energy must be much greater than can be obtained experimentally in order that this should become dangerous. Wireless-telegraph operations on the surface do not induce sparking potentials underground.

Capacity sparks in general from cables left insulated after being charged are very active, 0.002 to 0.005 joule causing ignition. The influence of gas in forwarding coal-dust explosions begins to be felt when one-half per cent of gas is present. At 2 per cent full ignitions are obtained at every trial. Coal-dust alone can be ignited by both continuous-current or alternating-current break-flashes, the former requiring 3.5 to 6 amperes at 480 volts in non-inductive circuits, the latter 14 amperes at 40 periods and on a power-factor of 0.8. Continuous-current faults on the negative cable develop rapidly in the presence of moisture and the cable is disintegrated.

Armoring is necessary under modern power conditions; lighting and signaling circuits must be equally well protected to prevent open sparking. The limits of safety are electrically low, but the risks of ignition are even now no greater than those attending the use of flame safety lamps, and they can be entirely prevented.

ILLUMINATION FEATURES OF BALTIMORE'S STAR SPANGLED BANNER CELEBRATION.

By F. M. Weller.

Thousands of brilliant electric lights, hundreds of columns, miles of bunting, banners and flags galore all gave their aid to the Star Spangled Banner celebration which took place at Baltimore during the entire week of September 7 to 12 inclusive. The occasion was in commemoration of the one hundredth anniversary of the Battle of North Point, in which the British were repulsed and birth given to the famous song "The Star Spangled Banner" by Francis Scott Key, just off the historic shores of Fort McHenry.

The city was in the gayest attire of its history, representing an outlay of over $100,000, and presented a beautiful setting for the inspiring industrial, municipal, historical, naval and military and other parades, which were continually taking place.

The illumination features were unusually brilliant and embodied an extensive use of the most modern illuminants besides several novelties which are mentioned herein.

Fig. 1 shows a section of the Centennial Colonnade or Court of Honor, which extended over Eutaw, Baltimore and Holliday Streets. This was composed of 112 tapering shaped latticed columns which stood 30 feet high and rested on a base 4 feet square. Each column was surmounted with an eagle standing on a bronzed globe. The columns were painted white and were placed along the thoroughfare from 50 to 75 feet apart.

Just above the base of each column an ornamented design bearing the figures "1814" was placed, and above this national banners tastefully decorated. The interiors of the columns were lined with incandescent bulbs which were lit at night, making the columns luminous. Electric bulbs were also placed in concealed positions at the top of each column, setting off the widespread eagles on the globes.

To complete an archway, thick streamers of garlands, dotted with 40 25-watt Mazda lamps were strung between the tops of the columns, and in the center of each archway a shield was suspended illuminated with varicolored lights. The graceful pillars with their flags and shields, and golden defiant eagles, the green streamers stretching across the streets and the intertwined bulbs all formed a wonderfully patriotic picture.

Fig. 2 shows a further view of the Centennial Way directly in front of the main reviewing stand and discloses in the background the gem-studded dome of the City Hall, completely outlined with electric lights. This latter decoration, which was done at a cost of $5,000, will be permanent, and at each future celebration the dome will be lighted.

Resplendent in the beauty of thousands of electric bulbs, the Court of Honor erected by the Masonic Order in front of the Masonic Temple on Charles Street was pronounced by experts and all to be the most beautiful decoration of its kind ever seen in this city. No public funds were used for this court of honor. The erection was said to have cost $10,000, and the total expense was borne by the Masonic lodges of the city.

The court consisted of 30 white towers, 30 inches square, 18 feet high, each capped with a filigree ball of steel four feet in diameter. The towers were made of wood frames and plaster panels. On each of the towers were symbols of the Masonry—the square, compasses and letter "G" predominating. On the south façade of each tower was a replica of a knight in armor, and flag decorations were to be found on all four sides. In the center of each steel ball was a 1,000-watt nitrogen-filled tungsten lamp in a 14-inch blue case glass ball. This specially designed globe was made with a blue interior and white exterior, giving a marked contrast to the other surrounding lighting units. From the four corners of each tower hung four 750-watt nitrogen tungsten lamps in 12-inch opal balls.

The arches at either end of the court were formed of piping. Fourteen 500-watt nitrogen tungsten lamps in 12-inch opal balls supplied the main lighting for each arch. Alternating with these units were groups of three tubular lamps of colors red, white and blue, respectively. The red and white lamps were 25 watts, and the blue 40 watts capacity each. An effect of solidity here was gained by double dipping these tubes, first in white, then in red or blue colors as desired.

The most beautiful feature of the court was the arch or main stand in front of the temple, spanning Charles Street. This arch was built of steel, wood and stucco, with a base color scheme of white. On each side of the arch were symbols of the order, and surmounting a ribbed dome above the arch, an emblem of the Templars—a cross and crown in colored bulbs. Topping all was a staff from which flew the American flag. From the arch band concerts were given every evening.

The turret dome and the main stand were outlined with 288 40-watt round-bulb frosted Mazda lamps, while 300 25-watt lamps of the same type were used in the body of the band stand. From each of the four pedestals, two at either end of the stand, swung a cluster of six 500-watt nitrogen-filled

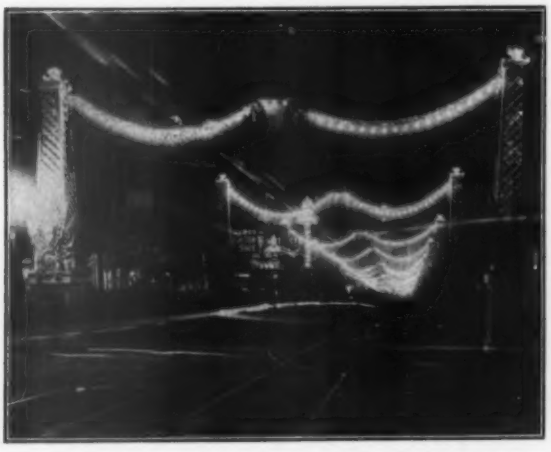


Fig. 1.—Court of Honor on Baltimore Street.

Fig. 2.—City Hall Dome and Court of Honor.

Fig. 3.—Masonic Court of Honor.

tungsten lamps. Around the head of the four main stand supporting columns were hung 12 750-watt nitrogen tungsten lights and to the under side of the stand, 10 500-watt similar units.

All the American shields and Masonic emblems were worked in as electric emblems in colors, employing 728 10-watt Mazda lamps. The front of the Masonic temple itself, besides being illuminated by the court of honor lighting, was further brightened by rows of lights along the ledges and cornices above the second floor, requiring for this purpose 150 40-watt and 140 25-watt units.

The entire scheme of illumination for the Masonic court was the design of W. R. Moulton, illuminating engineer of the Consolidated Gas, Electric Light & Power Company, and the electrical installation was made by the wiring force of the same company. K. B. Handley was scenic contractor.

A decided note of originality was struck in the lighting of several of the city's monuments, among the most conspicuous of these being the Francis Scott Key and the George Washington monuments. The scheme was such that no lighting bulbs were seen, but by a system of reflectors and strong concealed lights the monuments stood out as bright as day with their floral decorations.

The Key monument lighting consisted of four 400-watt, type C units placed in the base of the pool, all water having been drained off. On the upper pedestal white tin reflectors 15 by 9 inches with four 60-watt lamps, succeeded in throwing into beautiful relief the heroic figure of Liberty and her golden flag which surmounted the top. An unusual touch of color was obtained through the reddened "incense" arising from the marble bowl in the center of the second base.

This same principle was used with the Washington monument. Here the colored incense arising from the tall stands at the heads of the steps on each of the four sides of the base combined with the classic outlines of the marble-white shaft to make a picture of beauty and dignity which one, having once seen, will not soon forget.

The lighting of the shaft itself was supplied from four 1,000-watt stereopticon type concentrated-filament tungstens mounted each with a searchlight projector on the roofs of buildings in the four corners of the square.

Fig. 4.—Francis Scott Key Monument.

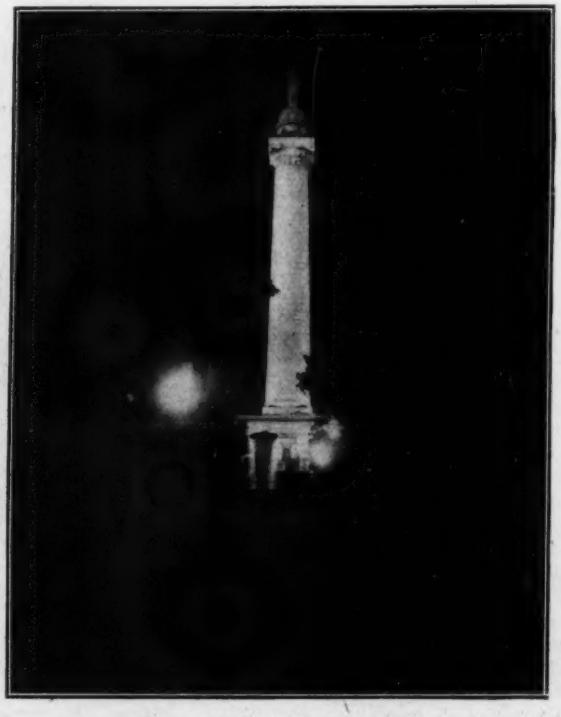


Fig. 5.—Washington Monument.

New Electrical and Mechanical Appliances

Fred M. Locke Develops New High-Tension Insulator.

Fred M. Locke, Victor, N. Y., has recently obtained patents upon a new insulating composition for the manufacture of high-tension insulators from boron, aluminum and silicate and from boron and silicate. Mr. Locke claims that this material is made up into an insulator superior both dielectrically and mechanically to porcelain, and that its specific inductive capacity is superior to any other known substance. The accompanying illustration shows one of the new insulators of the suspension type, measuring nine inches from the steel pin to the cap. It requires 110,000 volts to arc over the nine inches. Mr. Locke also states that, compared with a porcelain bushing requiring 60,000 volts for the arc-over, a bushing of the same length in the new material requires 90,000 volts. Under test he says it shows scarcely any static effect.

New High-Tension Suspension Insulator.

Dumore Electric Drink-Mixer.

In the design of motor-driven appliances it is as important to make sure of complete safety in operation as it is to ensure the reliability and economy of the device. This idea has been carried out in the new electric drink-mixer recently placed on the market by the Wisconsin Electric Company, Racine, Wis. This addition to the company's well-known Dumore specialties is exceptionally well constructed, great care being taken to eliminate all chance of shock to the operator. The switch knob and the button on the agitator shaft are made of a high-grade insulating compound and all live parts of the motor are thoroughly insulated from the parts coming in contact with the operator's hands.

The motor used in connection with the device is of the universal type and especially designed by Mr. Beach, electrical and mechanical engineer of the company. The entire machine is manufactured complete in the plant at Racine.

All parts of the appliance are standardized and interchangeable. The outfits come to the customer knocked down to prevent breakage in transit. All of the parts are self-adjusting, no tools being necessary to put the outfit together. Another very good feature of this new mixer is that the agitator shaft can be quickly removed and all parts easily gotten at.

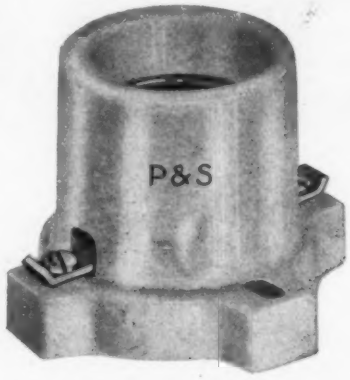
When the mixer is in operation the base is illuminated and the contents of the glass lighted up, making a sparkling and very pretty color effect.

Notwithstanding the fact that the Dumore mixer is cleverly designed and well and sturdily built, the manufacturers claim that on account of their very completely organized plant and automatic machinery they are able to market it at a very low figure.

New Electric Drink-Mixer.

New Mogul-Base Receptacle.

The firm of Pass & Seymour, Incorporated, Solvay, N. Y., has recently placed on the market a new cleat receptacle for use with mogul-base lamps. As shown in the accompanying illustration, this is a very rugged device. The design has been made generous in all respects. The current-carrying parts are not only of ample size, but are exceptionally strong from a mechanical standpoint. Thus the receptacle is very well suited to the requirements of high-power lamps, such as the large gas-filled lamps now coming into extensive use in commercial and industrial establishments.



Mogul-Base Receptacle.

Searchlights for the Panama-Pacific International Exposition.

Two hundred of the four hundred giant searchlights which will be used to flood the palaces and gardens of the Panama-Pacific International Exposition with vari-colored light reached San Francisco from the New York factories recently. Half of the shipment consists of 18-inch and half of 13-inch projectors. The latter are the smallest searchlights which will be used, and are to be installed on the roofs of all the main exhibit palaces, above the arches over the entrance gates, and on the six main towers of the courts, including the magnificent Tower of Jewels. The great reflector on this tower will be 432 feet above the ground, and the beam will be seen from far at sea.

The other searchlights, to arrive within a few weeks, will include 100 30-inch and 100 18-inch projectors, and a many-colored scintillator, consisting of a battery of monster lights and projectors of a new type, three and four feet in diameter, to be set up in Morro Castle. This novel "pipe-organ of iris-hued light" will play symphonies of

Fig. 1.—Semi-Indirect Reed Fixture.

color on the clouds, and on fantastic figures made of steam projected above the palaces through high-pressure pipes. This interplay of light will be met by the powerful beams from an enormous searchlight which will be set up on the crown of Mount Tamalpais, 15 miles away across the bay.

Reed-Ware Lighting Fixtures and Portable Lamps.

The greatly increased popularity of reed furniture for sun parlors, bright living rooms, porches, etc., has created a desire for reed-ware lighting fixtures and electric portables to carry out a harmonious effect in the entire equipment. To meet this need there has been developd and placed on the market a unique line of fixtures and lamps in which the entire exterior is made of attractively woven reed.

One of the most interesting of these designs is the semi-indirect bowl fixture shown in Fig. 1. This is made in six different sizes of bowls, ranging from 12 to 26 inches in diameter. Not only the bowl, but the canopy and even the chains are made of reed. The reed links forming the chains are decidedly novel and an original development by the manufacturer of these fixtures. The fixtures can be wired for any number of lamps desired. This type of fixture has a colored textile lining, which permits part of the light to pass through directly, giving a very pleasing effect.

In Fig. 2 is shown a five-light shower, of which the ceiling plate is 18 inches in diameter. The shades for the individual lamps are 7 inches long by 5.5 inches in diameter. Their shape is such as to conceal entirely the pull-chain

Fig. 2.—Reed Shower Fixture.

sockets used with this fixture. The soft illumination of the linings of these

Fig. 3.—Reed Bracket.

shades is attractive and restful. A wall bracket with the same style of shade is shown in Fig. 3. These brackets when used with the shower already described make an exceptionally pleasing and harmonious combination. They may also be used with other reed ceiling fixtures to good effect.

A great variety of reed lamps for both table and floor use are being made. The one shown in Fig. 4 is 24 inches high and has an 18-inch shade. It is equipped with two pull-chain sockets, an eight-foot length of silk-covered parallel lamp cord and swivel attachment plug. An artistic floor lamp is illustrated in Fig. 5. This is 5 feet, 6 inches high and has a 26-inch shade. It has four pull-chain sockets and is provided with a 15-foot cord and swivel plug.

These floor lamps are very handy as well as ornamental. They can readily be lifted by one hand, even by a lady, and this portability makes them very useful as reading or sewing lamps that can be easily moved to any desired position alongside a comfortable chair. Though the lamp is light in weight as a whole, the base is heavy enough to maintain equilibrium in case someone comes in contact with the outfit. These reed lamps, moreover, are practically unbreakable except under very violent usage.

Both the portables and fixtures are lined with either cretonne or silk; the pretty effects obtainable in floral cretonnes make this material usually preferable to silk. The designs shown in the illustrations are but a few of the approximately 50 different designs in this line of reed fixtures and portables, which are manufactured by the Chicago Reed Ware Manufacturing Company, 317 Union Park Court, Chicago, Ill. The company sells to dealers only.

Fig. 4.—Table Lamp.

Fig. 5.—Floor Lamp.

Fire and Police-Alarm Station at Panama - Pacific International Exposition.

The Department of Liberal Arts enjoys the distinction of having the first complete installed exhibit at the Panama-Pacific International Exposition, San Francisco, Cal. This is a working exhibit in the Palace of Liberal Arts, by the Star Electric Company, of Binghamton, N. Y., and forms the central fire and police-alarm signal station for the entire Exposition grounds. Installation was started by the Star Electric Company on May 16 of this year, the system being put into actual operation, with 52 boxes in service, on July 25.

The fire-alarm system comprises a central office with full automatic equipment, consisting of a twelve-circuit switchboard, an eight-circuit automatic repeater with four local engine-house circuits, a signal-wheel transmitter for transmitting still and special alarms, a punching register, take-up reel, and automatic time stamp for recording the exact time that an alarm comes in, the stamp being controlled by a self-winding electric clock. Metal battery racks carry the storage batteries for operating both the fire-alarm and police-telegraph systems. All testing of lines and batteries, and battery charging, is controlled from the main switchboard.

There are 102 fire-alarm boxes, of the latest approved type, now installed throughout the grounds and buildings. These boxes are known as the type "C" or Metropolitan boxes, and are absolutely noninterfering and successive, and so constructed that nine boxes may be pulled simultaneously, all of them registering in succession their respective signals.

Before the advent of this type of box, the greatest number of boxes which could be pulled simultaneously and insure a correct record was three. The insulation of the type "C" boxes is very high, as it has been proven by tests under actual working condition that 6,500 volts will not injure them.

Each of the three engine houses on the grounds is equipped with an ornamental pressed-steel panel, on which is mounted a twelve-inch electromechanical gong, punch register, tapperbell, take-up reel and an automatic light switch, which turns on the lights in the engine house on the first stroke of the alarm, these lights being automatically turned off by the switch at a predetermined time after the fire apparatus has left the house. There is also a similar set of apparatus in the headquarters of the Exposition Military Guards in the Service Building.

There will be 102 seven-call combination police telephone and signal boxes. These, together with the fire-alarm boxes, are mounted on ornamental iron pedestals, surmounted by a red globe, on which is etched "Fire Alarm" in white letters. A 25-watt Mazda lamp is used to illuminate the globe, during the night, to indicate the location of fire-alarm and police boxes, and by means of a signal-wheel transmitter, operated by an electric motor in the central office, code signals will be flashed on these lamps, to notify the guards that their services are required.

The central office police-telephone and signal system, is located in the same booth with the fire-alarm system. A six-circuit storage battery and control board provides facilities for charging the storage batteries, and making tests and connections. In addition to this, there is a four-circuit police desk, through which reports from guards, and telephone calls, are received. This desk is equipped with a four-pen register, automatic stamp for recording signals, and necessary switches for making telephone connections to the headquarters of the Military Guards.

In the Guard headquarters, at the Service Building, there is a four-pen register in synchronism with the register on the police desk in the central office, a flashlight connected with the signal system, and telephone connection with the central station.

A portion of the booth will be used by the Star Electric Company to exhibit its various types of fire-alarm and police-telegraph apparatus. The Exposition Company will have attendants present at all times.

The Vreeland Sine-Wave Oscillator.

For many experimental purposes it is necessary to have available a source of alternating current giving a pure sinusoidal wave form. What is known as the Vreeland sine-wave oscillator has been developed to generate pure-sine-wave single-phase current of constant, but readily adjustable, frequency. In the standard laboratory form of this oscillator the frequency can be adjusted between 250 and 2,500 cycles per second. The frequency can be varied by adjustment of the capacity or inductance of the oscillating circuit. The apparatus operates on an ordinary 110-volt direct-current supply. Conversion to alternating current is by purely electrical means free from revolving mechanical equipment; a specially designed mercury-vapor rectifier is used.

The general principle of this oscillator is made clear by the schematic diagram, Fig. 1. The actual relative positions of the rectifier tube and the primary and secondary coils are shown in side elevation in Fig. 2. The pear-shaped mercury-vapor tube T has a mercury cathode K and two similar anodes A_1, A_2. Direct current is supplied to these electrodes through an intervening pair of choke coils X_1 and X_2 and ballast resistances R_1 and R_2 on the positive side. Thus there are two symmetrical paths from the positive direct-current terminal, through the two anodes of the tube and through the mercury arc to the common cathode.

Shunted across the anodes is the oscillating circuit, which contains a capacity C and a pair of inductance or field

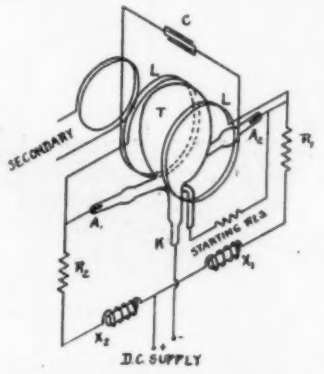


Fig. 1.—Scheme of Vreeland Oscillator.

coils L. These two coils are so arranged as to encircle the tube in a way to make their magnetic field traverse the tube in the direction perpendicular to the plane of the electrodes. Current in the field coils thus tends to deflect the arc toward one or the other of the anodes, depending on the direction of the flux.

The cycle of operation of the apparatus is as follows: After the arc is started, the current flows symmetrically in the two arc streams between the two anodes

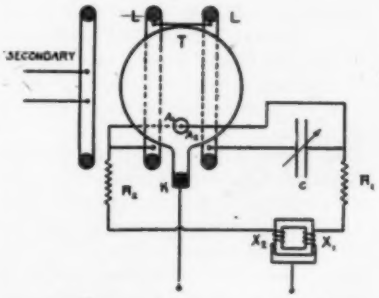


Fig. 2.—Arrangement of Sine-Wave Oscillator.

and the cathode, since the ballast resistances and choke coils maintain constant and equal currents in the two supply branches. Any current set up in the field coils L tends to deflect the arc toward one of the anodes, say A_1. Although this does not materially affect the division of current between the branches of the supply circuits, because of the choke coils, it does cause a current to flow in the oscillating current L C L

from anode A_1 to anode A_2. The field coils are so connected that this current tends to deflect still further the arc toward A_1; the resulting unstability continues until the condenser C is charged to its limiting potential. It then immediately discharges, reversing the current in the field coils L and the direction of the field flux resulting therefrom; this causes the arc to be deflected to the opposite anode A_2. This again brings about a charge and discharge of the condenser and with it rhythmic reversals of the current in the oscillating circuit. The frequency of the cyclic reversals depends on the natural period of the oscillating circuit, which is determined by the relative values of its capacity C and inductance L. Thus the apparatus is in a way analogous to the self-exciting generator, since the alternating currents developed are maintained by their magnetic fields.

In this apparatus there are no sudden surges or interruptions in the supply of energy to the oscillating circuit. Deflection of the arc is caused by a sinusoidal magnetic field, which impresses an approximately sinusoidal electromotive force on the oscillating circuit. To this smoothness and regularity of action is due the extreme purity of the wave form. The most rigid tests fail to disclose any harmonics. Oscillograph records are exceptionally smooth.

Fig. 3.—Panel Form of Vreeland Oscillator.

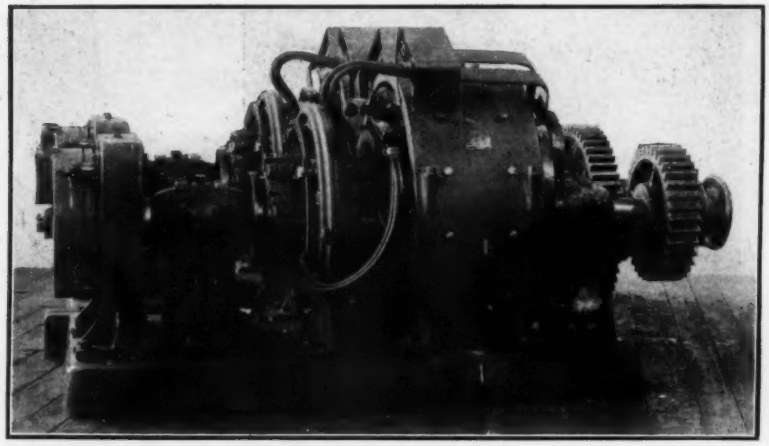
As shown in Fig. 2, a secondary coil is provided, from the terminals of which the working circuit is obtained. Thus the oscillating circuit is not tapped or interfered with directly. The secondary is adjustably mounted adjacent to the field coils L. The mutual inductance or coefficient of coupling may be varied by rotating the secondary coil on a fixed axis; this permits ready adjustment of the working electromotive force. Since the coefficient of coupling is usually small, variations in the working current or load do not materially affect the frequency of oscillation. Although the electrical efficiency of the apparatus is not high, no attempt was made in the design to achieve efficiency, but only a supply of pure-sine-wave current for refined test work.

Two forms of the apparatus are made. The laboratory type is provided with universal adjustments for frequency, current, voltage and mutual inductance of primary and secondary. The panel type, shown in Fig. 3, is a more rugged equipment containing all adjustments usually required, but eliminating some of the more expensive special features of the laboratory apparatus.

The Vreeland oscillator is being marketed by the Western Electric Company.

Electric Steering-Gear Motors.

Electric steering-gear motors, supplemented by steam steering-gear engine, provide an important feature in the most modern marine construction. A typical exampl of electric steering-gear mechanism is illustrated herewith. This set comprises two 150-horsepower, 120-volt, 250-revolutions per minute, direct-current motors which act singly or in unison as occasion requires. The mechanism is fitted with clutches of such character as to permit of an instantaneous shift from electric to steam control or vice versa, but as a matter of fact the electric steering gear when installed is used almost entirely to control the direction of the ship and the steam steering gear is kept for emergency use only.



Steering-Gear Motor Sets.

The motors are capable of pulling the rudder from hard over to hard over in 20 seconds when the vessel is moving at full speed ahead. They are supplied with an electric brake, which is applied automatically when the armature is de-energized. When the rudder reaches 35 degrees it is automatically stopped by a device which cuts off the current, but does not prevent the rudder being turned back by power toward the central position, and which automatically resets itself.

The motors are protected against overloads by a step-back relay, which automatically cuts resistance into the armature circuit, thus slowing down the motor which in turn slows down the rudder and decreases the load. As soon as the excessive load is removed the resistance is automatically cut out of the armature circuit.

The electric steering-gear motors illustrated were manufactured by the Diehl Manufacturing Company.

Sealing Wax for Electrical Fittings.

The electrical sealing waxes manufactured by the Insulating Materials Company, 805-821 Wesson Avenue, Detroit, Mich., have been approved by the Underwriters' Laboratories as standard for sealing screw heads, nuts, bolts and other live metal parts of electrical fittings wherever such sealing is required by the rules of the National Electrical Code. They are manufactured in two grades, one having a melting temperature in excess of 150 degrees Fahrenheit, the other having a melting point in excess of 200 degrees Fahrenheit, and either grade furnished in red, brown, black or white color, as required. In the Underwriters' tests these waxes were subjected to close and severe examination as to their electrical, moisture-proof and adherence properties, which points are of the utmost importance to the makers of electrical fittings requiring such wax. The company is prepared also to manufacture waxes specially designed to meet exceptional requirements.

A Novel Use of a Pumping Equipment.

A somewhat novel use of a pumping equipment has been installed in the city of Salinas, Cal. This city is located in the heart of the great Salinas Valley, in the center of a fertile agricultural district whose principal products are milk, butter, cheese, sugar beets, grain and alfalfa.

For a number of years irrigation carried on in this district has been done by means of gas-engine drive, but in the last few years electrical manufacturers have conducted a very effective campaign in order to convince the farmers of the advantages of motor drive for irrigation purposes.

The accompanying illustration shows a motor-driven pump installed in the public square in the center of the business district in Salinas. It is on the main street in full view of all the farmers coming to the city from the surrounding country. They usually tie their horses and park their automobiles at this point and therefore cannot fail to see the installation which consists of a five-horsepower Westinghouse electric motor direct-connected to a Byron-Jackson pump. The pump takes the water from a large tank and pumps it into a reservoir from which it flows back to the tank. This process is repeated over and over again. The capacity of the pump is 500 gallons per minute.

Motor-Driven Pumping Publicly Demonstrated.

Beardslee Inaugurates a Unique Dealer-Help Campaign.

The Beardslee Chandelier Manufacturing Company, Chicago, has inaugurated a co-operative campaign which it is offering to the electrical trade for increasing the sales of Christmas goods. The Beardslee idea is to furnish to the electrical dealer a distinctive line of seasonable gift lamps with such descriptive matter, follow-up literature and reminders as will enable the dealer to not only sell a greatly increased volume of Beardslee goods but many other current-consuming devices as well. The principal piece of literature is a beautifully printed book entitled "The Gift of Gifts." This bears upon its title page an illustration in purple and gold and a wrought-design lamp fixture embossed in the cover stock. The descriptive pages are printed in lavender and gold and illustrate so many types of gift lamps that the widest selection is available. Accompanying each illustration are some choice expressions relating to the adaptability of the gift lamp, together with a technical description for the dealer's information.

The prices shown in the book, while they are low, allow the dealer a liberal margin of profit.

The entire expense of getting the booklet into the hands of the dealer's customers will be borne by the Beardslee Chandelier Manufacturing Company. All that is necessary for a dealer to do is to furnish the company with a list of possible buyers. Printing, postage and follow-up literature costs are taken care of by the Beardslee Company. Each person whose name is furnished as a prospect by the dealer will receive a copy of the booklet with a letter stating that book has been sent at the dealer's request. There will be a postcard reminder that prompt action upon the part of the prospective customer will enable the dealer to give the customer the best service. A letter calling attention to the dealer's store and the fact that these portables are available will be mailed with the book. There will also be suggestions for a personal follow-up of the book, which will be furnished to each dealer using the plan. The service department of the Beardslee Company will also furnish cuts and copy for newspaper advertisements when desired.

No feature of modern merchandising principles has been overlooked to make this campaign one that will help to establish the electrical dealer more firmly in the public mind. The matters of window displays and store decoration are presented in a comprehensive manner and each of these features has been worked out by an experienced retail merchandise man. This campaign should be investigated by the electrical dealer who is interested in establishing a reputation for the handling of high-class goods on a logical merchandising basis. The booklet and other literature coming at this season of the year cannot fail to attract the attention of a very desirable class of buyers just when they are in the mood to purchase material of this character. Coming into the electrical dealer's store to become more familiar with the material advertised, the prospect gives the dealer an excellent opportunity for developing his sales of other material.

New Combination Electric Wet and Dry Grinder.

The combination grinder illustrated herewith has recently been developed by the Cincinnati Electrical Tool Company, Cincinnati, O. This outfit can be furnished either with two dry-grinder ends, two wet-grinder ends or as a combination of both, as shown by the illustration. The wet-grinder end is equipped with a water hopper.

Motor-Driven Dry and Wet Grinder.

The motor has a capacity of one horsepower at 1,750 revolutions per minute, and is manufactured by the Robbins & Myers Company, Springfield, O. It is completely enclosed to protect it from the water and dust, and is equipped with a snap switch on the frame and ten feet of cord with a plug, making the outfit portable. The outfit shown is for alternating current.

The grinding wheels are covered with guards, which give ample protection. Adjustable tool rests are provided. The motor is equipped with ball bearings and the greatest care is given to the balance of the outfit. It is claimed that it will run for at least five minutes after the current has been turned off.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

ATTACHMENT PLUGS, Fuseless.—Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

"Arrow" plug.

660 watts, 250 volts, catalog No. 6000.

Approved September 18, 1914.

CABINETS.—Sam Garvin & Company, 5124 West Lake Street, Chicago, Ill.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories, Incorported, to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Incorporated, have labels attached.

Approved September 15, 1914.

ELECTRIC-LIGHT BATH CABINET.—Federal-Huber Company, Halsted and Fulton Streets, Chicago, Ill.

This device is a stationary fixture in the form of a marble cabinet designed to inclose the bodies of persons while being subjected to the rays from 56 incandescent lamps mounted on the sides of the cabinet. The wiring is entirely inclosed in conduit or metal tubing with standard and special fittings.

The general design and workmanship shown in electrical and mechanical details of this cabinet are considered satisfactory.

The installation of these cabinets should be made in a manner and in a location satisfactory to the inspection department having jurisdiction.

Approved August 26, 1914.

FIXTURES. — Straight Filament Lamp Company, 42 East Twenty-third Street, New York, N. Y.

Fixtures shown by tests and examinations conducted by Underwriters' Laboratories, Incorporated, to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Incorporated, have labels attached.

Approved September 18, 1914.

FIXTURES. — Straight Filament Lamp Company, 42 East Twenty-third Street, New York, N. Y.

"Rayline" fixtures of the following types, having glass-lined metal reflectors with tubular lamps held by wire springs in special receptacles and having, except for show-window and show-case types, rubber insulation on the wires.

Show-window and show-case types have main supply wires of No. 14 B. & S. gauge with slow-burning insulation.

Portable types, Pa-43, 53, 74; Pb-43, 53, 74; Pc-43, 53, 74; Pe-53, 63, 74; Pf-41, 51, 72; Pg-43, 53, 74; Ph-43, 53, 74; Pj-43, 53, 74; Pk-43, 53, 74; Pm-43, 53, 74.

Cashiers' type, Ca-73, 74.

Wall-bracket types, Bb-43, 53, 74; Bc-43, 53, 74.

Show-window types, Wa-36, 46, 56, 76, 86; Wb-98, 108; Wc-118, 128.

Show-case types, Sa-4, 14, 24, 34; Sp-16, 26, 36.

Flat-surface types, Fa-43, Fb-43, Fc-43, Fd-107, Fe-197, Ff-107, Fp-45, Fr-45, Fs-45, Ft-107, Fu-107, Fw-107.

Drop types, Da-4, 33, 43, 53, 74, 97; Db-33, 43, 53, 74, 97; Dp-35, 45, 55, 76, 85, 97; Dr-35, 45, 55, 76, 85, 97.

Drawing-board type, Ea-43, 53, 97, 107.

Pendent type, Tp-40.

Approved September 19, 1914.

FLEXIBLE CORD.—New England Cable Company, Concord, N. H.

Marking: One orange thread running parallel with conductor between rubber insulation and braid.

Flexible cord shown by tests and examinations conducted by Underwriters' Laboratories, Incorporated, to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Incorporated, has labels attached.

Approved September 5, 1914.

HEATERS, Electric.—D. M. Steward Manufacturing Company, Chattanooga, Tenn.

Cook stove, 30 amperes, 110 volts.

Double hot plate, 20 amperes, 110 volts.

Single hot plate, 10 amperes, 110 volts.

Oven, 5 amperes, 110 volts.

Toast stove, 5 amperes, 110 volts.

Air heater, 10 amperes, 110 volts.

When connected to suitable supply circuits with approved fittings, in accordance with requirement of Rule 25 of the National Electrical Code.

Approved August 14, 1914.

INSULATING MATERIALS.—Insulating Materials Company, 805-821 Wesson Avenue, Detroit, Mich.

Sealing compounds made in red, white, black or brown color; made in two grades having melting temperatures in excess of 150 and 200 degrees Fahrenheit respectively.

For sealing screw heads, nuts, bolts and other live metal parts of electrical fittings where such sealing is required by the rules of the National Electrical Code.

Approved August 18, 1914.

PANELBOARDS.—Batavia Switchboard Company, Batavia, N. Y.

Panelboards shown by tests and examinations conducted by Underwriters' Laboratories, Incorporated, to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Incorporated, have labels attached.

Approved September 10, 1914.

PANELBOARDS. — Eynon Evans Company, Fifteenth and Clearfield Streets, Philadelphia, Pa.

Panelboards shown by tests and examinations conducted by Underwriters' Laboratories, Incorporated, to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Incorporated, have labels attached.

Approved September 18, 1914.

PICTURE MACHINES AND APPLIANCES.—Thomas A. Edison, Incorporated, Orange, N. J.

"Edison home kinetoscope," a portable kinetoscope and stereopticon for use only with Eastman slow-burning films (M. H. Report No. 184).

The electrical parts of this device comprise a small arc lamp, a special rheostat or transformer, and the necessary wiring connections. Rating, 5 amperes, 125 volts.

A miniature asbestos-board booth, to which the rheostat or transformer is attached, contains the machine and has a door hinged at the top, which may be easily and quickly closed.

For use only with slow-burning films supplied by the manufacturer.

This appliance presents such hazards as are necessarily involved in the installation and use of a device of this type by inexpert persons.

Note.—As the rating of the ordinary key or pull socket is 250 watts, 250 volts, and as this rating is not to be interpreted to permit the use, at any voltage of current above 2.5 amperes, the device described above should not be used on ordinary lighting circuits.

Approved August 31, 1914.

RECEPTACLES, for Attachment Plugs.—Chelton Electric Company, 314 Armat Street, Philadelphia, Pa.

"Chelton," 10-ampere, 250-volt, flush receptacle with composition base and plug, catalog No. 3000.

Catalog No. 5560, with plugs.

Approved September 18, 1914.

RECEPTACLES, Standard.—American Brass & Copper Company, 132 LaFayette Street, New York. N. Y., submitter; **The Yost Electric Manufacturing Company,** Toledo, O., manufacturer.

"American" brass shell receptacles.

Key, 250 watts, 250 volts, catalog Nos. A-250, A-255.

Keyless, 660 watts, 250 volts, catalog Nos. A-350, A-355.
Approved September 18, 1914.

RECEPTACLES Standard. — General Electric Company, Schenectady, N. Y.
"G. E." wall sockets, brass-shell.
Key, 250 watts, 250 volts.
Catalog Nos. 88959, GE336, GE339, GE342.
Key, 660 watts, 250 volts.
Catalog Nos. GE255, GE281, GE285, GE419-21 inclusive, GE423-26 inclusive, GE528.
Keyless, catalog Nos. 88960, GE337, GE340, GE343, also (1500 W. Mogul base) GE075-78 inclusive.
Pull, catalog Nos. GE338, GE341, GE344.
Also above with shadeholders attached.
Approved August 11, 1914.

RECEPTACLES, Standard.—The Electrical Manufacturing Company, Denver, Colo.
"Princess" wall sockets, square brass shell.
Key, 250 watts, 250 volts; catalog Nos. 1830, 1832.
Approved September 18, 1914.

RECEPTACLES, Standard. — The Yost Electric Manufacturing Company, Toledo, O.
"Yost" brass-shell receptacles.
Key, 250 watts, 250 volts; catalog Nos. Y-250, Y-255.
Keyless, 660 watts, 250 volts; catalog Nos. Y-350, Y-355.
Approved September 19, 1914.

RHEOSTATS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
"C-H" self-starters for 110, 220, 440, 500 and 550 volts, alternating and direct current, consisting of individual and grouped switches for cutting out the starting resistance, as described in the manufacturer's bulletins.
Direct-current self-starters; bulletin Nos. 3500, 4400, 4402, 4404, 4406, 4408, 4410, 4415, 6090, 6095, 6100, 6105, 6120, 6130, 6140, 6141, 6160, 6161; with knife switch and fuses, 6250, 6300, 6310.
Alternating current self-starters; bulletin Nos. 9600, 9610, 9630, 9640, 9660, 9670, 9680.
Approved September 12, 1914.

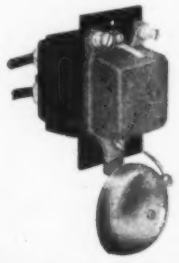
ROSETTES, Fuseless.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.
"Arrow E," 3 amperes, 250 volts.
"Midget;" cleat, catalog Nos. 900, 1999.
Interchangeable; molding, catalog Nos. 401, 402, 8072, 8073; with connecting block, catalog No. 405; conduit box, catalog Nos. 457, 458, 525, 526, 8074-8077 inclusive.
Approved September 18, 1914.

ROSETTES, Fuseless. — Harvey Hubbell, Incorporated, Bridgeport, Conn.
Ceiling pull-switch rosettes, catalog Nos. 5990, 5991, 5995, 5996, 5999, 6000-6016 inclusive, 6029; with "Economy" extender, catalog Nos. 6001, 6002, 6006, 6007, 6010, 6011, 6020-6023 inclusive, and 6036.
Approved August 26, 1914.

ROSETTES, Fuseless.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.
"Arrow E" rosette with pull-socket mechanism.
3 amperes, 125 volts; 1 ampere, 250 volts.
Catalog Nos. 395, 396, 422, 423, 424, 461, 8560-65 inclusive.
Approved September 18, 1914.

ROSETTES, Link Fuse.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.
"Arrow E" rosette with pull-socket mechanism, 2 amperes, 125 volts.
Catalog Nos. 414, 415, 8566, 8567.
Approved September 18, 1914.

SIGNAL APPLIANCES.—Musolaphone Corporation, 110 South Dearborn Street, Chicago, Ill.
Control board for loud-speaking telephones.
Musolaphone control board No. 2, consists of a panel for the connection of a special transmitter to a 110-volt, direct-current circuit through lamp resistances. Variations in the resistance of the transmitter cause condensers to be charged and discharged, thereby



Bell Transformer.—A. E. Rittenhouse Company.

producing a fluctuating current in a reproducer circuit in which are connected one or more special receivers with amplifying horns.
When connection to supply circuit is installed in accordance with the requirements of Class C of the National Electrical Code.
Approved August 26, 1914.

SOCKETS, Weatherproof. — The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.
"Arrow E" porcelain-shell keyless sockets.
660 watts, 250 volts, catalog No. 4037 (for temporary outdoor use and only when connected to stranded rubber-covered wires).
660 watts, 600 volts, catalog Nos. 399, 50997 (for use with incandescent lamps in series on 600-volt circuits).
Approved September 1, 1914.

SOCKETS, Standard.—Harvey Hubbell, Incorporated, Bridgeport, Conn.
Brass-shell, 250 watts, 250 volts.
Pull; catalog No. 35024, with lamp-base attachment.
For use with brass-shell sockets and receptacles, and also with porcelain sockets and receptacles when installed in locations where the use of brass-shell, fiber-lined sockets and receptacles would be permitted under the rules.
Approved September 18, 1914.

SOCKETS, Standard.—The Yost Electric Manufacturing Company, Toledo, O.
"Yost" brass-shell sockets.
Key, 250 watts, 250 volts, catalog Nos. Y-200, Y-205, Y-210, Y-215.
Keyless, 660 watts, 250 volts, catalog Nos. Y-300, Y-305, Y-310, Y-315.
Approved August 18, 1914.

SOCKETS, Standard. — American Brass & Copper Company, 132 LaFayette Street, New York, N. Y., submitter; **The Yost Electric Manufacturing Company,** Toledo, O., manufacturer.
"American" brass-shell sockets.
Key, 250 watts, 250 volts, catalog Nos. A-200, A-205, A-210, A-215.
Keyless, 660 watts, 250 volts, catalog Nos. A-300, A-305, A-310, A-315.
Approved August 19, 1914.

SWITCHES, Knife.—The Eynon-Evans Manufacturing Company, 1524 Clearfield Street, Philadelphia, Pa.
"White" switches, with or without extensions for National Electrical Code fuses, 125 volts, 30, 60 and 100-ampere capacities.
Approved August 21, 1914.

SWITCHES, Push-Button Flush.—The Trumbull Electric Manufacturing Company, Plainville, Conn.
Single pole; five amperes, 250 volts, 10 amperes, 125 volts, catalog No. 201.
Double pole; 10 amperes, 250 volts, catalog No. 202.
Three-way; five amperes, 250 volts, 10 amperes, 125 volts, catalog No. 203.
Approved September 4, 1914.

SWITCHES, Surface-Snap; sub-bases for.—Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.
"H. & H." porcelain sub-bases.
Cleat type, catalog Nos. 2987, 2901, 2995.
Concealed type, catalog Nos. 2988, 2992, 2996.
Molding type, catalog Nos. 2989, 2990, 2993, 2994; also 1556 for molding work only and 1558 for concealed and molding work only.
Approved August 26, 1914.

SWITCH BOXES.—The Potter Manufacturing Company, Cleveland, O.
Pressed-steel switch boxes made in 1, 2 and 3 gang, for mounting flush switches and receptacles.
Approved August 28, 1914.

TRANFORMERS.—The A. E. Rittenhouse Company, Honeoye Falls, N. Y.
"SB" bell-ringing transformer, 110-volt primary, 10-volt secondary. Designed for mounting in a standard box.
Standard only for ringing bells or for similar signaling work when the primary wiring is installed in accordance with Class C of the National Electrical Code. (See cut.)
Approved August 24, 1914.

WIRE, Rubber-Covered.—Astoria Wire Company, Astoria, N. Y.
Marking: One red and one yellow thread parallel to wire between insulation and braid.
Rubber-covered wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.
Approved September 3, 1914.

Current Electrical News

NORTH ATLANTIC STATES.

LYNDONVILLE, VT.—A petition is being circulated asking that a special village meeting be called to consider the advisability of renovating the municipal electric lighting and power plant. The cost of putting in new machinery and bringing the plant up to its most prifitable basis is estimated at $22,000 to $25,000. Address the village clerk.

ST. ALBANS, VT.—The residents on the south side of Lake Street are raising money to install 11 ornamental street lights.

NORWOOD, MASS.—This town has voted to adopt a "business charter," to go into effect in January, whereby a business manager will handle all departments of municipal affairs, including the town lighting service. The plan is modeled on the German method of city management, and Norwood is the first town in Massachusetts to adopt it. W.

SEEKORK, MASS.—The Selectmen have arranged with the Seekork Electric Company to light four miles of the public ways. W.

TAUNTON, MASS.—The municipal council is being petitioned by the Chamber of Commerce to provide a "White Way" for Taunton.

MANCHESTER, CONN.—The town has voted to appropriate $270 a year to co-operate with the merchants on North Main Street for the equipment of a "White Way." Under this arrangement the business men and property owners pay half the cost of the lighting equipment.

WINDSOR LOCKS, CONN.—The Selectmen have been authorized to make a five-year contract with the Northern Connecticut Light & Power Company for municipal lighting. W.

ALBANY, N. Y.—The Depew & Lancaster Light, Power & Conduit Company has filed an amended certificate for the purpose of extending its business in the towns of West Seneca, Elma, Marilla, East Hamburg, Wales, Clarence, Newstead and East Aurora. George R. Teller is president and Ernest Teyler is secretary of the company.

NIAGARA FALLS, N. Y.—Buffalo & Niagara Falls Electric Light Company will build a large transformer station and distribution plant on the line of the Erie Railroad, north of Perry Avenue, same to cost $60,000.

SOUTH ATLANTIC STATES.

CHARLOTTE, N. C.—The Piedmont & Northern Railway Company, operating a high-speed electric interurban line between Charlotte and Gastonia and Greenville and Greenwood, S. C., is planning the building of an extension between Spartansburg and Gastonia, a distance of 32 miles. The company proposes to extend the line northward from Charlotte to Concord, N. C., about 25 miles, and also plans an extension from Concord to Salisbury, Greensboro and Durham, N. C.

LYONS, GA.—A vote will be taken upon the proposition of enlarging the electric light plant. Address the mayor.

NORTH CENTRAL STATES.

CAMDEN, O.—On November 3 the people will vote on a proposed bond issue of $35,000 for the purpose of building and equipping a municipal light and water plant, which is being designed by the Reliance Engineering Company, Cincinnati.

CANTON, O.—The Municipal Electric Light Association is planning ways and means to establish a municipal lighting plant. Address I. D. Lovett for desired information.

READING, O.—Bonds to the amount of $1,500 have been sold for the purpose of providing funds for the improvement of the village electric light plant, for which new material will be purchased. L.

INDIANAPOLIS, IND.—Specifications for a lighting contract for parks, boulevards, park buildings and bridges have been adopted by the Board of Park Commissioners. The time of opening bids will be determined upon at the next meeting of the Board.

EAU CLAIRE, WIS.—Mayor Fleming and Councilmen Barnes and Lockerby have recently held a conference with General Manager Manley of the Wisconsin-Minnesota Light & Power Company, relative to the matter of installing an ornamental "White Way" in connection with the city lighting. The company will submit figures as to the probable cost.

MONTELLO, WIS.—Montello & Harrisville Electric Light & Power Company, has been incorporated with a capital of $40,000 by D. W. McNamara and others.

SHAWANO, WIS.—The municipal electric light company plans to erect a water power plant to develop 400 horsepower and install an engine of about 30 horsepower. Address Paul E. Caprano, superintendent and chief engineer, for desired information.

DULUTH, MINN.—At a recent meeting of the Hillside Commercial Club a committee was appointed to secure signatures for a petition asking for the construction of a "White Way."

DE WITT, NEB.—The city council is considering plans for an electric light plant to cost about $15,000. Address the village clerk for information.

DYERSVILLE, IOWA.—Municipal lighting may be established when the present contract with the Dyersville Light & Water Company expires. Address W. C. Loosbrock.

FAYETTE, IOWA.—The municipal lighting is unsatisfactory and improvements are necessary. Address the city clerk for particulars.

OELWEIN, I O W A. — Oelwein Light, Heat & Power Company has secured the services of George H. Rowe, of Utility Development Company of Chicago, and a large plant is to be built in the place of the one recently destroyed by fire.

REASNOR, IOWA.—J. B. Van Baren is planning to install an electric light plant here.

TROY MILLS, IOWA.—A company at this place to develop water power on the Wapsipinicon River was recently incorporated with an authorized capital of $40,000. W. R. Furman is president and G. F. Furman is general manager.

SOUTH CENTRAL STATES.

BEATTYVILLE, KY. — Organization of the Beattyville Utilities Comuany, with $10,000 capital has been effected, a contract made with the city for electric lights and construction work for the plant and the wire systems is well under way. E. P. Bullock, Jr., who is supervising installation, promises service in a month.

HARRODSBURG, KY.—If the City Council, which controls the municipal electric plant, will quote satisfactory rates, two local enterprises will use electricity for power. One is the Harrodsburg Ice & Produce Company, which proposes to convert its present system into one electrically operated, and the other is the Up-to-Date Milling Company, which through Will Smock, announces the plan to equip the 50-barrel flour mill it proposes to build with electric motive power.

LEXINGTON, KY.—A comprehensive "white way," which would include all the retail section of this city is planned by a merchants' committee, of which Simon Wolf is chairman. It provides for two-arm standards, each with one high-power light to hang over the gutters and another to hang over the sidewalks. The plans meet the approval of most of the business men, and a sample standard is to be displayed soon, after which an effort will be made to provide for the installation in time for the Christmas shopping season. The idea includes purchase of the fixtures by the merchants and maintenance by the city.

PEEBLES, KY.—A municipal electric light plant has been approved in an election recently held.

MEMPHIS, TENN.—The Arkansas Light & Power Company is planning extensive improvements, and in order to finance these it has filed a mortgage in favor of the Guaranty Trust Company of New York, securing payment of its two-year 6 per cent notes. It is specified that the latter are not to exceed $1,000,000. The company operates plants at Malvern, Camden, Arkadelphia, Magnolia and other points in the state. The company will not only improve its present plants, but

will add to the number, and is considering the advisability of erecting a power dam at Caddo Gap.

GADSDEN, ALA.—The city contemplates building an electric light plant. Address Charles L. Marsh, city engineer.

JACKSON, MISS.—A municipal water plant is under consideration, the plans being to erect a power plant at the water works plant. The cost of this will be approximately $155,000, according to figures submitted by the city engineer. Address the mayor in regard to the matter.

GRETNA, LA.—The city contemplates installing an electric light plant, to cost about $30,000. The mayor should be addressed for particulars.

PORT LAVACA, TEX.—The Citizen's Light and Water Company, which has just been organized at Port Lavaca, will construct an electric light and power plant. D.

CRYSTAL CITY, TEX.—The City Council has granted a 25-year franchise to A. D. Riddle, of Cotulla, Tex., for the maintenance of an electric plant in Crystal City.

WESTERN STATES.

WHITE OAKS, N. M.—The Wild Cat Leasing Company will construct an electric power transmission line from its plant at White Oaks to Carrizozo. It will also extend its power system to the mines at Nogal, N. M.

DUNCAN, ARIZ.—Surveys are being made for a new power project on Black River at the mouth of Pachete Creek. F. G. Baum and associates of San Francisco and John Christy of Clifton, Ariz., are the promoters. The plan is to build a dam across the creek and install a hydroelectric plant.

CHEHALIS, WASH.—The Independent Electric Company has been granted a franchise for a high-tension power line from Winlock to Toledo.

ASTORIA, ORE.—F. C. Harley, of the Astoria Harbor Improvement Company, is back of a movement which has for its object the installation of a "Great White Way" on Eleventh Street from the water front to Exchange Street, the work to be paid for by the property owners. O.

PORTLAND, ORE.—The City Commission has granted permission to business men and property owners on Fourth Street, to install a system of street bracket lights, and work on this improvement will be started as soon as plans can be prepared. The installation will be made from Yamhill to Burnside Street, on Fourth Street, and the cost of the work will be promptly paid by property owners. O.

AZUSA, CAL.—Preparations are being made for the calling of a $55,000 bond election in the near future, part of the proceeds of which will be used for a lighting plant costing $20,000.

FRESNO, CAL.—The Board of Trustees is preparing for the installation of an electrolier lighting system on both sides of all the streets in the business district. Plans and specifications are on file with the city clerk.

FRESNO, CAL.—A. G. Wishon, manager of the Midland Counties Public Service Corporation, has announced that a new transmission line is being built from Santa Maria to Lompoc, which will cost about $15,000. The current will be released to the Lompoc Light and Power Company for general distribution.

HEMET, CAL.—Trustees J. H. Frazier and B. W. VanWinkle have been appointed a committee to obtain figures on the probable cost of electric lighting and water systems for the municipality.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county has voted to install 84 new street lights in the Hawthorne district.

LOS ANGELES, CAL. — Nearly $100,000 has been set aside under first allowances of the 1914-15 budget of the Pacific Telephone & Telegraph Co. for expenditures in the southern California district, according to an announcement by Division Superintendent Mason. Plans call for the rebuilding of the toll line through the Santa Ana Canyon; the expenditure of $35,900 in replacing the temporary toll line construction on the Los Angeles and San Francisco line, and $11,000 will be spent in placing an aerial cable on Normandie Avenue from Slausen to Manchester.

PASADENA, CAL.—The city trustees have advertised for bids for lighting Fair Oaks Avenue.

PASADENA, CAL.—The municipality is preparing to install ornamental street lights on El Molino and South El Molino Avenues.

POMONA, CAL.—A special committee had been appointed to further the proposed ornamental lighting system for this city. Sample lights have been installed on Third Street.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained by writing and giving file number to the Bureau of Foreign and Domestic Commerce, Washington, D. C.; or the nearest of its branches at New York City, Chicago, New Orleans, San Francisco, Atlanta, Seattle, and Boston.]

NO. 13,942. ELECTRODES.—An English electrical company has notified an American consular officer that it would like to receive quotations, stating best deliveries, from American manufacturers on 20 tons of electrodes for exporting. Dimensions, etc., of electrodes desired are indicated on a diagram which may be seen at the Bureau of Foreign and Domestic Commerce. The company asks that manufacturers submit a sample pair of carbons. Dates of possible delivery are also requested.

NO. 13,945. STEATITES.—An American consul in Italy reports that a manufacturer of automobile spark plugs in his district is anxious to receive prompt offers of manufactured steatites to be used for making insulators of electricity at high temperatures. References and guaranties will be furnished. Correspondence should be in French or English.

NO. 13,955. METALLIC-FILAMENT ELECTRIC LAMPS.—An American consular officer in Italy reports the name and address of a dealer who desires to receive offers from American manufacturers of metallic-filament electric lamps. References will be furnished. Correspondence should be in French or English.

PROPOSALS.

WIRING AND FIXTURES.—Separate bids for electric work and fixtures will be received by the Board of School Inspectors of Peoria, Ill., until October 28, for the new high school building. Plans and specifications are on file in the office of the board. Miss Anna Rynearson is secretary. Z.

WATER-TIGHT LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Engineer Depot, Washington Barracks, D. C., until October 31, for furnishing miscellaneous quantity of water-tight lighting fixtures. For further information address JOSEPH E. KUHN, lieutenant colonel of engineers.

LIGHTING EQUIPMENT. — Proposals for electric wiring and fixtures for the new buildings of the Rhode Island School for Feeble Minded, at Slocum, R. I., will be received by the Rhode Island Board of Control and Supply, State House, Providence, R. I., until October 29. Specifications can be obtained from the secretary.

ELECTRIC LIGHTING FIXTURES.—Sealed proposals will be received by the Board of Commissioners of Lima, O., until November 6, for the erection of the Lima State Hospital, for the furnishing and installing of lighting fixtures according to the plans, descriptions, bills, estimates nad specifications prepared by Frank L. Packard, architect, Columbus, O. For information address M. J. Burke, president.

ELECTRICAL EQUIPMENT. — Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until October 27 for furnishing 278 storage batteries, f. o. b. works, as per Schedule 7402; one alternating-current generator set, direct-current motor and two galvanometers, one contactor, wire rheostats and one transformer, as per Schedule 7400 for delivery at the Navy Yard, Annapolis, Md.

CONDUIT AND WIRING.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until October 22 for furnishing a conduit and wiring system and lighting fixtures at the United States appraiser's warehouse, New York, N. Y., in accordance with drawings and specification, copies of which may be had at Washington or at office of the supervising chief engineer, United States custom house, New York, N. Y., in the discretion of the supervising architect.

INTERIOR LIGHTING FIXTURES. —Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until November 12 for furnishing the interior lighting fixtures of a two-story building for the post office at The Dalles, Ore., and until November 19 for the same for a one-story building for the post office at Fayetteville, Tenn., both in accordance with drawings and specifications, copies of which may be obtained either from the custodians of the sites named or the office of the Supervising Architect.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until October 27, for furnishing one electric hoist, as per Schedule 7369, 1,000 feet three-conductor 600-volt cable and miscellaneous single-conductor cable, as per Schedule 7395, all for delivery at the Navy Yard, Puget Sound, Wash.; six portable ventilating sets, one-quarter horsepower, and 10 multipolar portable ventilating sets, one-quarter horsepower, as per Schedule 7386.

FINANCIAL NOTES.

Judge Hazel, in the Federal Court, denied the application of Alfred Stickney, representing the Central Trust Company, for an order authorizing the sale of the United States Light & Heating Company. The stockholders' protective committee and merchandise creditors were authorized to intervene. James O'Moore, one of the receivers, and Louis Posner, attorney for the company, opposed the motion, claiming that the company would soon be in good financial standing.

Samuel Insull says public utilities have suffered less loss in earnings as result of the European war than other enterprises of equal proportion. Mr. Insull sees nothing to cause change in dividend policies of his principal companies. Commonwealth Edison has shown a substantial increase throughout the year thus far. Public Service and Peoples Gas Company have followed the same course, although to a slightly lesser degree. Chicago Elevated's August and September earnings decreased slightly, but the year to date increased around 2 per cent. The Insull companies outside of Chicago, gained around 14 per cent during the past three months, following 20 per cent increase during May and June.

The Pacific Power and Light Corporation for August, 1914, made a gain of $10,614, or nine per cent, over August of 1913. For the year ending August 31, 1914, gross earnings increased $73,903, or six per cent, over the preceding twelve months, with gain of $97,511, or 16 per cent in net, and an increase of $56,981, or 21 per cent, in surplus after charges. The balance after preferred dividends for the year was $86,407, a gain of $50,731.

At the annual meeting of the stockholders of the Northern Electric Company of California, the following directors were elected: President, Leon Sloss; L. E. Hanchett, chairman of the board; Percy T. Morgan, John D. McKee, John S. Drum, Louis Sloss and W. P. Harmon.

New officers have been elected for the Yosemite Power Company of California, which was formed by the consolidation of the Tuolumne Light & Power Company and the La Grange Water Company, as follows: President, J. G. Barker; first vice-president, Fred G. Hamilton; second vice-president, E. A. Wiltsee; treasurer and controller, P. M. Longen; directors, the foregoing and Albert Raymond.

The San Diego Gas & Electric Company, operating over 600 miles of territory in San Diego county, Cal., has applied to the Railroad Commission for authority to issue $500,000 face value six-per-cent debenture bonds to be used in discharging floating indebtedness.

At annual meeting of Philadelphia, Reading & Pottsville Telegraph Company A. T. Dice was elected a director, to succeed T. Voorhees, resigned. Other directors and officers were re-elected.

James D. Mortimer, president of the North American Company, was elected a director of the United Railways of St. Louis, a North American Company subsidiary, to fill the vacancy caused by the death of James Campbell. Directors took no action on electing a successor to Robert McCulloch, late president and director of the United Railways of St. Louis.

Dividends.

	Term.	Rate.	Payable.
American Lt. & Trac. pf.	Q	1.5 %	Nov. 2
American Lt. & Trac. com. (in com.)	Q	2.5 %	Nov. 2
Asso. Gas & El. pf.	Q	1.5 %	Oct. 15
Edison Co. of Boston	Q	$3	Nov. 2
Edison Co. of Brockton.	S-A	$4	Nov. 2
Ft. Worth Pr. & Lt. pf.	Q	1.75%	Nov. 1
Havana Elec. Ry., Lt. & Pr. pf.	S-A	3 %	Nov. 14
Havana Elec. Ry., Lt. & Pr. com.	S-A	2.5 %	Nov. 14
J. G. White & Company, pf.	Q	1.5 %	Nov. 1
Milwaukee Elec. Ry. & Lt. pf.	Q	1.5 %	Oct. 31
Public Service Invest. pf.	Q	$1.50	Nov. 2
J. G. White, Inc., pf.	Q	1.5 %	Nov. 16

Reports of Earnings.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.

The report of the American Telephone & Telegraph Company to the Massachusetts Public Service Commission, for the year ended June 30, 1914, compares as follows:

	1914.	1913.
Gross	$12,098,580	$20,116,907
Operating expense	10,880,285	10,005,075
Net	1,218,295	10,111,832
Other income	40,981,667	31,182,189
Total income	42,199,962	41,294,021
Charges	9,396,788	8,082,424
Surplus	*32,803,173	33,211,597
Dividends	27,568,644	27,050,934
Total surplus	5,234,529	6,160,663

*Equal to 9.52 per cent on $344,516,500 capital stock outstanding, as against 9.63 per cent on $344,552,400 stock previous year.

Miscellaneous income was derived from the following sources:

	1914.	1913.
Real estate revenue	$ 29,387	$ 51,363
Divs. on stks. other companies	25,920,488	25,912,751
Int. on bonds, notes, etc.	6,080,117	5,199,193
Miscel. income	59,477	18,881
Rev. from licensed cos. for rights and priv. of conn. gen. svcs. and use of tel. patents and other property	8,892,297	8,346,158
Total	40,981,667	39,528,348

The reserve account as of June 30, 1914, follows:

	1914.	1913.
Res. for acct. depr.	$12,117,422	$11,403,793
Res. for conting'cies.	17,504,652	28,514,305
Res. for emp. bft. fds.	2,034,579	2,022,147
Total	31,656,653	41,940,246

GALVESTON-HOUSTON ELECTRIC.

	1914.	1913.
August gross	$ 228,733	$ 223,139
Net	119,506	105,125
Surplus after charges	83,298	70,481
Twelve months gross	2,460,399	2,289,112
Net	1,103,005	980,474
Surplus after charges	663,399	567,942

DALLAS ELECTRIC.

	1914.	1913.
August gross	$ 174,775	$ 180,734
Net	71,302	77,089
Surplus after charges	37,827	52,079
Twelve months gross	2,277,091	2,072,482
Net	923,240	870,261
Surplus after charges	580,510	573,971

NORTHERN TEXAS ELECTRIC.

	1914.	1913.
August gross	$ 174,662	$ 185,885
Net	79,543	80,748
Surplus after charges	53,483	56,582
Twelve months gross	2,158,252	2,078,036
Net	953,015	961,483
Surplus after charges	647,686	671,714

TAMPA ELECTRIC.

	1914	1913
August gross	$ 82,811	$ 71,624
Net	40,289	31,959
Surplus after charges	35,831	27,606
Twelve months gross	957,024	796,303
Net	423,626	368,429
Surplus after charges	378,895	313,302

SAVANNAH ELECTRIC COMPANY.

	1914	1913
August gross	$ 71,339	$ 70,983
Net	24,822	24,674
Surplus after charges	1,890	1,874
Twelve months gross	851,035	803,661
Net	284,372	244,973
Surplus after charges	10,282	7,334

CONSOLIDATED GAS & ELECTRIC.

James E. Aldred, president of the Consolidated Gas, Electric Light & Power Company, of Baltimore, in his annual report to stockholders said in part:

"Your company entered upon the past fiscal year subject to a substantial reduction in rates for both gas and electricity ordered by the Public Service Commission of Maryland on January 3, 1913, and made effective July 1, 1913. The commission's orders reduced the maximum rate for gas from 90 to 80 cents net per thousand cubic feet and the maximum rate for electricity from 10 to 8.5 cents per kilowatt-hour.

"The fact that your company has been able to recover, within one year, the greater part of the loss occasioned by the reductions in rates must not, however, be misconstrued, for your company has been deprived of the additional profits for this year which would otherwise have resulted from the great increase of business secured.

"Your management feels that the last year's work of your company will demonstrate to the public that increased earnings on decreased rates can be secured only by the most aggressive methods of securing additional business and greater efficiency in operation."

The report for the year ended June 30, 1914, compares as follows:

	1914.	1913.
Total income	$6,400,896	$6,114,973
Net	3,067,074	3,151,792
Surplus after charges	1,499,385	1,675,025
Dividends	891,562	810,672
Depreciation	460,000	460,000
Special reserve	125,000	300,000
Balance	22,824	104,352

NEW INCORPORATIONS.

MINOT, N. D.—Minot Electric Company has been incorporated with a capital of $5,000 by George H. Todd and others.

TIGERTON, WIS.—The Tigerton Electric Company has been incorporated with a capital of $10,000 by J. C. Mueller and others.

PRAIRIE FARM, WIS.—The Prairie Farm Electric Company has been porated with a capitalization of $75,000. O. A. Osterich and others.

PEORIA, ILL.—The National Electric & Auto Supply Company has been incorporated with a capitaliation of $75,000. The incorporators are Ralph V. Miller, Theodore E. Bass and H. H. Moody.

LAKETON, IND.—Akron & Laketon Utility Company has been incorporated with a capitalization of $25,000 to supply electricity to cities and towns. The directors are W. K. Stevenson, V. J. Lidecker and Charles W. Harter.

CLEVELAND, O.—The Cleveland Electric Motor & Manufacturing Company has been incorporated with a capital stock of $10,000, to handle an electric manufacturing business. W. K. Stanley and others are interested.

NEW YORK, N. Y.—Dale Lighting Fixture Company, Incorporated, has been granted articles of incorporation to deal in gas and electric fixtures. The capital stock is $25,000 and the incorporators are David Haar, S. Michael Cohen and Dora E. Horwitz.

NEW YORK, N. Y.—Coin Device & Signal Company, Incorporated, has been granted articles of incorporation, capitalized at $70,000, to manufacture coin-collecting and indicating devices, electrical engineering, etc. The incorporators are G. M. Mazza, H. A. Drew and E. C. Hobcroft.

PERSONAL MENTION

DR. WALTER NERNST, inventor of the Nernst lamp has received the honorary degree of Doctor of Engineering from the Technical School in Dantzig, Germany.

MR. W. T. KYLE has joined the sales force of the Okonite Company at its general office, 253 Broadway, New York City. Mr. Kyle for the past six years has been connected with the Duplex Metals Company as district sales manager.

MR. GEORGE MILTENBERGER, formerly of Perry, Mo., has been appointed manager of the Hickman, Ky., electric light and water plant, succeeding Mr. W. D. Moss, who resigned some time ago. The Perry plant and the Hickman plant are under the same ownership.

MR. ARTHUR M. SUMNER, for ten years assistant superintendent of the Rockingham County Light & Power Company, Portsmouth, N. H., has resigned from that position, to take effect October 15. He will probably enter business for himself. Mr. Sumner went to Portsmouth from the General Electric Company's Boston office in 1904.

MR. THEODORE F. KUECHLE, formerly with the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., will have charge of the electrical department of the Columbus, O., Trade School. He is a graduate of Ohio State University, and has held important positions with large electrical firms. In his new place he succeeds Mr. E. C. Raney, who has resigned to accept the management of the Automatic Reclosing Circuit Breaker Company, Columbus, O.

MR. CHARLES C. BECKMAN, superintendent of way and structure of the Mahoning & Shenango Railway & Light Company, recently moved his office from Sharon, Pa., to the main office of the company in Youngstown, O. The purpose of the change is to give Mr. Beckman a more central location for his work, inasmuch as he has the direction of all the way and structure on the entire system. His home will continue to be in Sharon, where he has resided for many years.

MR. JAMES HARMON, for the last four years claim and safety agent of the United Gas & Electric Company of New Albany and Jeffersonville, Ind., latterly including the Insull railway properties in southern Indiana in the scope of his office, has been made general claim and safety agent for all the Insull public utility properties in Indiana, according to an announcement recently posted in New Albany. He will have headquarters in Indianapolis and enter on his larger duties the first of November. Mr. Harmon has been advanced from time to time from the ranks of the employees of the company, having gained his practical information at first hand.

MR. SAMUEL INSULL, of Chicago, president of the Commonwealth Edison Company, visited Dayton, O., last week as the guest of the Dayton Engineering Club, which he addressed, showing the benefits to the public of the greater efficiency which can be attained by a single central station in a city, as against the waste and relative inefficiency of several competing stations, whether privately or publicly owned. Mr. Insull's visit came at an opportune time to enable him to inform city officials and others interested regarding the relative merits of municipal ownership and private ownership of electric plants, his vast experience giving his opinions considerable weight. While in Dayton he was entertained by E. A. Deeds, vice-president of the National Cash Register Company.

MR. CHARLES A. HOWE has been appointed general sales manager of the George Cutter Company, South Bend, Ind. It will be remembered that Mr. Howe resigned his position as manager of the Chicago office of the Holophane Company in April, 1911, to become treasurer and general manager of the Holophane Company, Limited, in Canada, with headquarters at Toronto. Mr. Howe had been connected with the Holophane Company for 10 years before coming to Chicago. Recent developments in the Canadian business situation owing to the unsettlement of conditions brought about by the outbreak of hostilities abroad, determined Mr. Howe to return to the United States. Always an active participant in electrical affairs and with a host of friends and acquaintances particularly in the Chicago vicinity, Mr. Howe will prove a valuable acquisition to the George Cutter Company. He is a member of the Illuminating Engineering Society and has prepared several papers for presentation to state and national electrical organizations. Just prior to his departure for Canada in 1911 he was elected a vice-president of the Electric Club of Chicago.

OBITUARY.

DR. FREDERICK ERB, well known for his work in radiotelegraphy, and head of one of the departments of the Telefunken Company, was killed on August 9 at Mühlhausen. He was a lieutenant in the German reserve army.

PROF. KARL BAEDECKER, professor of physics in the University at Jena, Germany, lost his life in one of the early battles of the present war. He was 37 years of age and had specialized in electrical theory.

MR. GEORGE S. SEARING, for 23 years general western manager for the Hart & Hegeman Manufacturing Company, Hartford, Conn., died on Sunday, October 11, at his home in Chicago, 911 Windsor Avenue. Mr. Searing was born in Jamaica, Long Island, in 1848, and came to Chicago in 1885. The passing of "Colonel George," as he has long been known to the electrical fraternity, will be mourned sincerely. A prominent figure for years and years at state and national gatherings of electrical men, his sweetness of disposition and his unswerving devotion to the square deal in business have established for him a reputation that is singular. During the last few years of his life, when sorely stricken time and time again and he has been at death's door, his friends have rallied around him, expressing their devotion many times in the most material fashion. In tender remembrance of George S. Searing the word would not be complete without a reference to the wonderful sympathy and unselfish attention which all through his affiction has been given him by Mrs. Searing, and which has won for her the affection and esteem of everyone both in and out of the industry who has witnessed it.

DATES AHEAD.

Electric Vehicle Association of America. Fifth annual convention, Philadelphia, Pa., October 19-21. Secretary, A. J. Marshall, 29 West Thirty-ninth Street, New York, N. Y.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual convention, Arkansas City, Kans., October 22-24. Secretary, W. H. Fellows, Leavenworth, Kans.

Association of Railway Electrical Engineers. Annual convention, Chicago, Ill., October 26-30. Secretary, J. A. Andreucetti, Room 411, Chicago & Northwestern Terminal Station, Chicago, Ill.

Telephone Pioneers of America. Annual reunion, Richmond, Va., October 29-30. Secretary, Henry W. Pope, New York, N. Y.

American Physical Society. Columbia University, New York, N. Y., October 31. Secretary, A. D. Cole, Columbus, O.

American Society of Mechanical Engineers, New York, N. Y., December 1-4. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., announces that owing to the growth of its business in the Cincinnati territory, it has been necessary to remove the company's Cincinnati office from the Fourth National Bank Building to 812 Gwynne Building, Cincinnati, O.

The Metropolitan Electric Manufacturing Company, Fourteenth Street and East Avenue, Long Island City, N. Y., has prepared two catalogs devoted to a description and illustrations of switchboards and electrical appliances. Copies of these catalogs will be sent to those interested upon request.

The Dale Lighting Fixture Company, 107-109 West Thirteenth Street, New

York, N. Y., announces that it has purchased the entire plant and show rooms of the Dale Company. The new company will continue to make and sell this well-known line of lighting fixtures and specialties, and there will be no change in the management or personnel.

The Kandem Electric Company, Incorporated (formerly the Koerting & Mathiesen Company), 49 East Fourth Street, New York, is distributing an interesting advertising souvenir entitled "Has the American Business Man Lost His Nerve?" This contains some philosophy with respect to present opportunities and the relation of the Excello arc lamp to a realization of present business possibilities.

J. H. Parker & Company, Parkersburg, W. Va., have ready for distribution a complete catalog illustrating and describing porcelain insulations. These include knobs, cleats, bushings, switch bases and special pieces made by the dry process, and tubes, insulators and special pieces made by the wet process. The catalog is so arranged that reference is facilitated and the illustrations render an easy understanding of the characteristics and appearance of each piece of material.

Mathias, Klein & Sons, 562 West Van Buren Street, Chicago, have prepared some very interesting literature relating to the "Staysalite" torch. In the few months that this torch has been on the market a thousand have been sold. Some of the features of the torch include its small compact size so that it can be placed in the lineman's kit, or used as a pocket torch; it can be hung under a sleeve-joint on the line to be soldered by a quarter turn of the torch, leaving the hands free, and then released by a quarter turn in the opposite direction; there is a permanent receptacle for soldering paste handily located inside of the torch.

The Phoenix Glass Company, 15 Murray Street, New York, N. Y., has published several pieces of handsome literature relating to its various products. Catalog No. 28 is especially striking in design and execution. The various forms of Phoenix bowls and special shapes are shown in rich brown upon a light buff background, which brings out in considerable detail the exceptionally artistic conceptions which grace these up-to-date examples of illuminating glassware. Accompanying each illustration is a catalog number and full information is given respecting list prices and dimensions. Catalog No. 27 is devoted to descriptions and illustrations of green-plated glassware. This is also very attractively presented. These catalogs, as well as the latest bulletin on globes for nitrogen lamps, may be secured by those interested upon application to the company.

Record of Electrical Patents.

Issued by the United States Patent Office, October 6, 1914.

1,112,433. Electrical Ground-Detector. H. W. Brown, assignor to Westinghouse Electric & Mfg. Co. Describes details of the instrument.

1,112,435. Electrical Conversion System. S. Cabot, Brookline, Mass. Includes a source of alternating current, a transformer, a condenser and means in synchronism with the source for conveying direct current from the resonant circuit to the working circuit.

1,112,436. Electric Conversion. S. Cabot. For converting constant-potential A. C. to constant-current D. C. through a synchronously driven commutator.

1,112,438. System of Electrical Distribution and Regulation. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Includes a storage battery, a booster generator, an exciter for supplying its field and control resistances therefor.

1,112,439. Electric-Circuit-Control System. R. J. Dearborn, assignor to Westinghouse Electric & Mfg. Co. Automatic changeover arrangement for connections of locomotive operating on both high and low voltage.

1,112,441. System of Storing Power. R. A. Fessenden, Brant Rock, Mass. Combined with a windmill and two reservoirs at different elevations is an electric machine usually operated by the windmill, a pump in the lower reservoir, another electric machine near the lower reservoir usually driven by a water turbine, and connections by which the two machines may be operated by either windmill or turbine.

1,112,452. Winding for Induction Motors. T. Hoock, assignor to Westinghouse Electric & Mfg. Co. Winding consists of a transversely folded strip with slits to permit the folds to be inserted in the slots of the core and cause the teeth to project through the slits.

1,112,457. Automobile Signal. W. Krebs, Albany, N. Y., assignor of one-half to A. L. Dutcher. Electric lamp signal.

1,112,458. Arc-Light Electrode. I. Ladoff, Cleveland, O., assignor of three-tenths to W. D. Edmonds. For flaming arc; contains calcium titanate and titanofluoride of an alkaline metal.

1,112,466. Plug Switch. G. K. Mitchell, Baltimore, Md. Has a socket to which rigid blade-holding members are affixed.

1,112,469. Antiseptic Holder for Telephone Mouthpieces. J. G. O'Donnell, Washington, D. C., assignor of one-third to C. J. Helmsen and one-third to E. A. Helmsen. A powdered antiseptic is held in a perforated carrier in the outer shell.

1,112,473. Electric Signal System for Railways. F. J. Pilgrim, (V. Pilgrim, administratrix), assignor to E. G. Long Co., New York, N. Y. Railway danger signal operated by cams fastened to the trolley wire.

1,112,480. Dry Cell. J. E. Runner and W. A. Pfieterer, Dunkirk, Ind. Covers details of the construction.

1,112,481. Automatic Brake Mechanism for Trains. J. Samuels, Rock Slope, Ala., assignor to J. Samuels, E. Thomason, W. C. Long, and J. E. Lacey. Electrical control for the volume of air maintained.

1,112,482. System of Multicurrent Distribution. H. M. Scheibe, assignor to Westinghouse Electric & Mfg. Co. A vapor rectifier with means for breaking both alternating and direct-current circuits upon abnormal load in the latter.

1,112,495. Duplex-Pressure Electric Pump-Governor. W. V. Turner, assignor to Westinghouse Air Brake Co. A valve operates contacts leading to the air-compressing motor.

1,112,497. Telephone System with Automatic Ringing. R. I. Utter, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Means for alternately connecting the supervisory relay and ringing current with the called line.

1,112,548. Electric Railway System. E. J. Murphy, Gary, Ind., assignor of one-half to L. B. Gump. Surface-contact system.

1,112,549. Apparatus for Amplifying or Detecting Electrical Variations. G. W. Pierce, Cambridge, Mass. Mercury-vapor bulb as wireless detector.

1,112,571. Mechanism for Electrically Indicating and Recording Lock Keys. A. L. Sohm, assignor to Sohm Electric Signal & Recording Co., Spokane, Wash. Has an electric contact for each of the tumblers.

1,112,580. Device for Operating Magnetos. E. A. Watts, assignor to Miller Improved Gas Engine Co., Springfield, O. A spring forms the driving connection between the armature shaft and engine.

1,112,582. Electric Heater. F. R. Whittlesey, Oakland, Cal. Covers construction of the heating element.

1,112,592. Burglar-Alarm Device. L. H. Berg, New York, N. Y., assignor of one-half to L. Jerkowski. A circuit-making and breaking device.

1,112,624. Electric-Lamp Mount. E. S. Keogh, Freeport, N. Y. Miniature incandescent lamp mounted on top of dry cell.

1,112,634. Lightning Conductor. L. L. Mast, assignor to D. H. Mast, West Milton, O. Coupling for lighting rod.

1,112,639. Circuit-Breaker. C. H. Miller, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Includes an overload magnet and a restraining coil effective after cessation of overloads.

1,112,645. Signal Apparatus. J. D. Nelson, Cincinnati, O. Fire-alarm box for transmitting D. C. and A. C. signals.

1,112,655. Apparatus for Receiving or Relaying Electric Signals. G. W. Pierce, Cambridge, Mass. Wireless detector or amplifier; includes vacuum bulb.

1,112,657. Circuit-Controlled Finger for Electrically Operated Musical Instruments. W. C. Reed, assignor to Telectric Co., Pittsfield, Mass. For contacting through perforations in the music roll.

1,112,658. Circuit-Controlling Finger for Electrically Operated Music-Playing Apparatus. W. C. Reed, assignor to Telectric Co. Amplification of above.

1,112,682. Electric Regulation. J. L. Creveling, New York, N. Y., assignor to Safety Car Heating & Lighting Co. Generator regulator for axle car-lighting system.

1,112,743. Thermostat. J. G. Wall-

mann, Oakland, Cal. Heat-regulated circuit-controller.

1,112,745. Controller for Elevators. C. W. Wheeler, Chicago, Ill. Electromagnetic motor-starter rheostat.

1,112,750. Annealing and Tempering Apparatus. E. H. Angle, New London, Conn., and A. H. Ketcham, Denver, Colo. Electric tempering bath.

1,112,784. Means for Controlling Electric Currents. E. L. Gale, Sr., assignor to Otis Elevator Co., Jersey City, N. J. Elevator motor controller.

1,112,785. Traction Elevator. E. L. Gale, Sr., assignor to Otis Elevator Co. Electromagnetic brake for elevator motor.

1,112,788. Electrical Resistance. F. W. Gore, New York, N. Y. For arc lamp.

1,112,795. Igniter. A. B. Herrick, assignor to M. C. Messler, Pawtucket, R. I., Combination spark plug and induction coil.

1,112,807. Device for Distributing Disinfectants or Other Fluids. A. T. King, Atlanta, Ga. Disinfecting receptacles are mounted on the guard of an electric fan.

1,112,831. Axle-Generator Support. P. L. Pflager, assignor to Pullman Co., Chicago, Ill. Details of mounting a car-lighting dynamo.

1,112,833. Automatic Regulation for Electrical Apparatus. C. P. Poole, South Orange, N. J., assignor to Engineering Development Co. Dynamo with split field has part of field flux varied as speed of machine changes.

1,112,841. Selector Apparatus. H. O. Rugh, Sandwich, Ill., assignor to Hall Switch & Signal Co. Electromagnetic substation selector of step-by-step type.

1,112,882 and 1,112,883. Electric Snyder, Lancaster, N. Y., assignor to Gould Storage Battery Co. Battery tray providing for ventilation about the cells.

1,112,863. Reverse-Phase Safety-Relay for Motor-Circuits. C. H. Spangler, Reading, Pa. Is actuated by a reversal of any of the phases.

1,112,865. Portable Buffer. W. C. Stevens, assignor to Firestone Tire & Rubber Co., Akron, O. Motor-driven tire buffer.

1,112,882 and 1,112,883. Electric Switch. F. Barr, New York, N. Y. Two patents covering details of pull switch for lamp socket.

1,112,884. Motor for Electric Shears. H. M. Barrer, Chicago, Ill. Solenoid-operated. (See cut.)

1,112,886. Machine for Making, Setting and Justifying Type. B. F. Bellows, assignor to Electric Compositor Co., New York, N. Y. Electrically operated; patent has 206 claims.

1,112,903. Electrical Installation. H. H. Ham, Shrewsbury, Mass. Special switch for controlling electric head and tail lamps of automobiles.

1,112,908. Transformer. A. S. Hubbard, assignor to Gould Storage Battery Co. Core-type transformer with primary and secondary windings and a short-circuited turn forming one terminal.

1,112,912. Trolley. H. Jolly, Michigan City, Ind. Has a sleet scraper and three trolley wheels in tandem.

1,112,913. Electric-Current Converter. A. T. Kasley, Swissvale, Pa. A special current-interrupter.

1,112,915. Locking Device. J. A. Keyes, New York, N. Y. Electromagnetically operated ratchet moves the bolt.

1,112,925. System of Motor Control. W. D. Lutz, assignor to Otis Elevator Co. Special arrangement of electromagnetic reversing switches.

1,112,953. Outlet-Fixture for Current-Conductors. W. M. Webb, assignor to H. T. Paiste Co., Philadelphia, Pa. Angle conduit fitting with removable electrical cover.

1,112,974. Combination Pressure-Gage and Deflation-Signal. J. H. Brown, Midvale, Utah. Electric tire alarm.

1,112,977. Closure-Locking Means for Gas Retorts. H. A. Carpenter and A. W. Warner, assignors to Riter-Conley Mfg. Co., Pittsburgh, Pa. Electrically operated device for locking the closure.

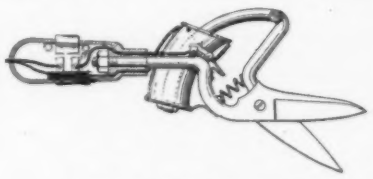
1,112,978. Means for Controlling the Operation of Gas Retorts. H. A. Carpenter and A. W. Warner, assignors to Riter-Conley Mfg. Co. Has a tool-actuating motor and motor-controlling devices at opposite ends of retort.

1,112,994. Speed-Indicator for Calling Devices. J. Erickson, assignor to Automatic Electric Co., Chicago, Ill. A solenoid-operated device for telephone testing.

1,113,013. System of Car-Signaling for Grade-Crossings. W. N. Johnson, Williamsport, Pa., assignor of one-half to L. C. Smith and H. W. Smith. Sidelights on cars illuminated by motorman upon approaching crossing.

1,113,038. Fuse. Giles Moore, Frankfort, Ind. An inclosed fuse in which the element is held taut by means of a spring.

1,113,052. Safeguard Life and Telephone Attachment. I. E. Rosenthal, Argenta, Ark. A device for engaging



1,112,884.—Electric Shears.

the telephone hook to move the same so as to sound an alarm.

1,113,087. Oil Switch. H. P. Ball, assignor to General Electric Co. A number of contacts in a closed chamber are arranged so that excess pressure due to arcing at one set of contacts tends to extinguish the arcs at another.

1,113,092. Box-Supporting Flush Plate. F. R. Beugler, assignor to G. C. Lee, Jr., and H. M. Underwood, Binghamton, N. Y. A plate is fastened to switch box for supporting same flush with wall.

1,113,094. System of Speed Regulation. L. E. Bogen, assignor to Allis-Chalmers Mfg. Co. A shaft-contact device causes water rheostat to be placed in circuit to reduce speed of machine.

1,113,102. Safety Switch. H. W. Cheney, assignor to Allis-Chalmers Mfg. Co. For use with electric hoist.

1,113,125. Thermostatic Circuit-Closer. J. M. Johnson, Kansas City Kans. Electric contacts communicate with a mercury column.

1,113,126. Thermostat. J. M. Johnson. Modification of above.

1,113,128. Annunciator. O. M. Leich, assignor to Cracraft, Leich Electric Co., Genoa, Ill. Has a removable coil and core mounted in the framework.

1,113,134. Induction Electric Furnace. W. S. Moody, assignor to General Electric Co. Has two primary windings in multiple, one being inside the crucible and the other outside.

1,113,138. Cable Splice. A. J. Penote, Cleveland, O. Splicing member consists of a series of sector-shaped blocks arranged with straight sides in contact.

1,113,143. Bushing for Trolley Wheels, Pulleys, Etc. J. C. Sharp, Chattanooga, Tenn. A bushing with transverse oil feed.

1,113,146. Vaporizer for Use With Electric Fans. J. E. Stratford and J. A. Ackley, assignors to Diffuse-Zone Disinfecting Co., Houston, Tex. Disinfecting reservoirs in front of the fan.

1,113,147. Magneto-Electric Ignition Apparatus. A. Zähringer, Stuttgart, Germany. A ring fitted in an annular recess for engagement with a recess in pole shoes, to center the armature.

1,113,149. Wireless Receiving System. E. H. Armstrong, Yonkers, N. Y. An Audion receiving system having a resonant wing circuit interlinked with a resonant grid circuit.

1,113,154. Safety Device for Electrically Heated Cooking Apparatus. L. G. Copeman, Flint, Mich. A fuse of sufficient carrying capacity but of low fusing point is inserted in heater.

1,113,156. Engine-Starter. F. E. Fisher, Detroit, Mich. Electric starter cutfit.

Patents Expired.

The following United States electrical patents expired October 12, 1914.

591,376. Signaling on Railways. A. C. T. Bond, London, England.

591,395. Magnetic Coupling. T. J. Fay, Brooklyn, N. Y.

591,426. Electrical Protector. C. A. Rolfe, Chicago, Ill.

591,427. Galvanic Battery. C. B. Schoenmehl, Waterbury, Conn.

591,451. Electric Switch. J. C. Cassidy, East Orange, N. J.

591,490. Fitting for Glow Lamps. F. Palm, Nuremberg, Germany.

591,491. Electric Switch. J. W. Parkin, Philadelphia, Pa.

591,499. Electric Dental Mallet. P. Russel, New Market, Md.

591,516. Electric Rail-Bond. W. H. Wiggin, Worcester, Mass.

591,571. Process of and Apparatus for Electrolytic Recovery of Metals from Their Solutions. J. W. Richards and C. W. Roepper, Bethlehem, Pa.

591,578. Elevator. G. H. Tuttle, Braintree, Mass.

591,590. Switch Apparatus. J. P. Coleman, Swissvale, Pa.

591,623. Dynamo-Electric Machine. E. W. Farnham, Chicago, Ill.

591,624. Telegraph Key. E. W. Farnham.

591,625. Dynamo-Electric Machine. E. W. Farnham.

591,628. Street-Railway Switch. D. W. Hatfield and G. W. Hatfield, New Haven, Conn.

591,641. Electric Meter. G. A. Scheeffer, Peoria, Ill.

591,698. Trolley. G. K. Shryock, Johnstown, Pa.

591,700. Thermic Fire-Alarm. K. O. Slosky, Philadelphia, Pa.

591,706. Electric Railway. D. Urquhart and F. Wynne, London, England.

591,730. Process of and Apparatus for Electrolyzing. W. Bein, Berlin, Germany.

591,783. Electric Heater. O. D. McClellan, Philadelphia, Pa.

Electric Vehicle Section

THE ELECTRIC VEHICLE.

The story of "The Electric Vehicle in Chicago," which appears upon the following pages, is full of interest and value to every element associated with the electric vehicle industry. There are over 3,500 cars of the passenger and commercial types in service in Chicago. An organization possessed of large resources, manned by a personnel of superior intelligence and capability, the Commonwealth Edison Company has gone a long way toward making the utilization of the electric vehicle a matter of primary importance in the development of its power load and in its relation to the income enjoyed by the company.

Viewing the situation the country over and eliminating from consideration the successful meeting of the issue in a comparatively few large cities, we are prone to find fault with the progress made in the popularizing of the electric vehicle. The facts are, however, that the electric vehicle has made as much progress as has any other electrical utility within recent history. The electric vehicle has been the subject of intensive cultivation. This has been due very largely to the individual efforts of the leading manufacturers of electric vehicles. They have, however, made, to our minds, the mistake of going directly to the ultimate consumer, forcing back the demand upon the central station rather than first exerting their greatest possible educational effort upon the technical intermediaries necessary to the ultimate success of their business. Wherever the electric vehicle manufacturer has failed to make an ally of the central-station interests of the country he has overlooked his greatest possible asset.

When we consider the progress that the electric vehicle has already made we can look with a great deal of cheerfulness toward the prospect of a great increase when there will have been developed a thorough-going system of co-operation upon the part of the several interests involved. The central-station manager and the manufacturer of the electric vehicle are still some distance apart. Both parties to the problem have been bombarded with gratuitous advice and we can imagine the central-station manager at least heaving a sigh of relief if for a brief period he might be left alone. But this cannot be. Anything that retards the development of central-station service gets in the way of every other interest manufacturing an article going into the electrical industry. The makers of current-consuming devices of every description are busy upon plans for creating wider markets for their products. The central-station manager is expected to understand the problems of each and to be in sympathy with all of them.

As a logical subject for central-station consideration the electric vehicle seems appropriate. The best opinions of those who ought to know favor the central station aggressively attacking the proposition of popularizing the electric vehicle. It means increased income for the central station; it means increased opportunity for the makers of many electrical accessories; it is worthy of the study of all of us; it is worth while particularly for the electric vehicle manufacturer to make the central-station man his ally.

There are electric-vehicle prospects among the merchants and manufacturers of every city and town reached by central-station service. The commercial departments of the central station are continually in touch with these prospects. They solicit their business for store and factory illumination, for sign lighting and for motor equipment. The influence of these solicitors upon behalf of the electric vehicle is worth securing upon almost any basis within reason.

It is expected that the convention of the Electric Vehicle Association of America, which will be held at Philadelphia, October 19, 20 and 21, will throw much light upon this subject. Upon the last page of this Electric Vehicle Section will be found a list of the papers and addresses which have been prepared. These are full of promise, and it is hoped that from this gathering central-station men and manufacturers of electric vehicles and accessories will go forth understanding each other's problems better and equipped to speedily bring about the increased use of the electric vehicle that its advantages deserve.

The Electric Vehicle In Chicago.

Chicago Has the Distinction of Being the First City in the Country in Point of Electric-Vehicle Development, There Being Over 3,500 Cars in Service. The Causes That Have Been Responsible for This Development Are Discussed Fully Herein, and Should Be of Interest to All Concerned in the Advancement of the Electric.

This article describes electric vehicle conditions in Chicago with special reference to the activities of the Commonwealth Edison Company. The transportation department of this company is described and information concerning its work in stimulating the development of the electric given. Data are also given on the garage and charging facilities of Chicago and the activities of the various interests to increase the number of vehicles in service.

Chicago, with its customary enterprise and adaptability to modern conditions, has taken the leadership of cities in the United States in the number of electric vehicles operated on its streets. Authentic figures place the total number of electrics in this country at 37,000, 25,000 of which are passenger cars and 12,000 of the commercial type. Of this number, Chicago has the distinction of having about 3,850 while New York and Cleveland each have about 2,000. Denver, Boston and Washington come next with 1,000 each.

The difficulties which at first surrounded the introduction of the electric vehicle are rapidly being dissipated.

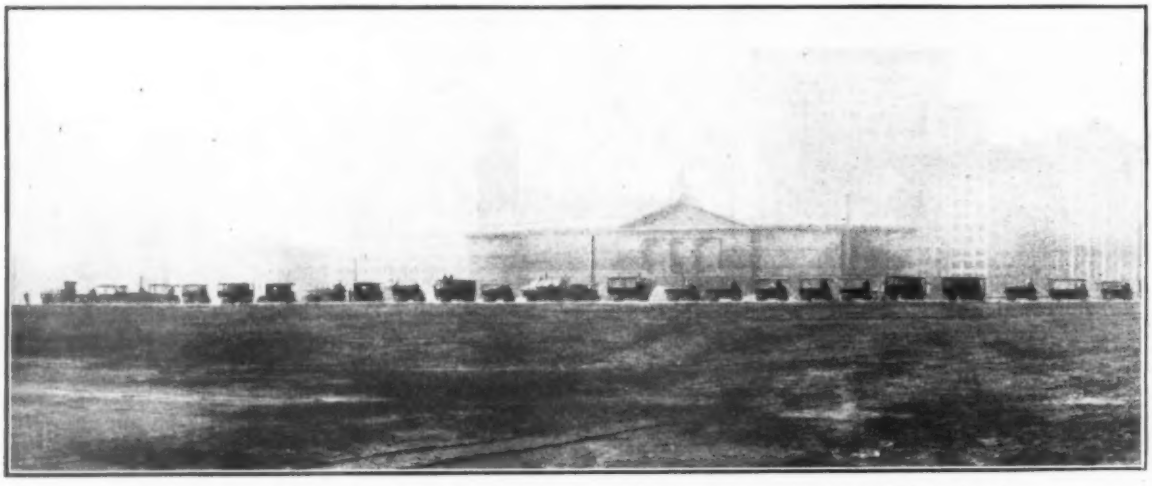


Fig. 1—One-half of a Panoramic View of Commonwealth Edison Electric Vehicles On Lake Front.

While, for the most part, these were more of a mental, rather than a physical character, which time alone could ameliorate, still the development of two features, speed and mileage, has brought the electric car to a point where, except for unusual requirements, it can be said to actively compete with the gasoline car.

The electric was at first only considered where short trips were to be made. Today, in both the passenger-car and commercial fields the mileage has been increased so that a car can now cover on a single charge about all the distance usually required for one day's run. With boosts at noon, from 150 to 175 miles can easily be accomplished. That the passenger car has great potential possibilities as a means of touring is convincingly demonstrated by the remarkable runs made by Col. S. R. Bailey. In the 1,305-mile trip from Boston to Chicago, 100 miles per day were made for over half the distance and on one day 173 miles were traveled. The average speed for the entire trip was 15.6 miles per hour, and this was done in spite of extremely poor road conditions and unusually inclement weather. On city streets and boulevards a speed of 20 to 25 miles can be maintained, which is as fast as should be undertaken with safety. Few people seem to realize that in the electric passenger car the speed is only a question of gearing and should the demand for greater speed arise the manufacturers can easily meet the requirements.

In Chicago there are somewhat over 3,000 electric vehicles of the passenger type. Of these, about 2,000 are charged in public garages and 735 at private charging stations. One hundred and seventeen are charged at isolated plants and an average of 148 are in storage or otherwise unaccounted for. The rates in public garages average between $30 and $40 per month, which includes washing, polishing, adjustments, and delivery to and from the owner each day. The average consumption of the private charging stations is 150 kilowatt-hours per month. The total monthly energy consumption of the passenger-car garages purchasing power from the Commonwealth Edison Company is 571,000 kilowatt-hours, which makes the average consumption per car per month in garages, 300 kilowatt-hours.

The mileage and service of commercial cars has increased even more rapidly than is true of the passenger vehicle. Speeds average from 10 to 15 miles per hour and 50 to 60 miles on a charge is no unusual performance. On April 1, 1914, there were 761 commercial electric vehicles in Chicago. Of this number 638 were charged on

Commonwealth Edison service and 123 on outside power. The average kilowatt-hour consumption per month per vehicle is 517.

The figures shown in the table appearing on the last page of this article, compiled by the Commonwealth Edison Company, shows the operation costs in cents per mile for different sizes of vehicles. The costs, of course, apply to vehicles in the company's own service, and it is insisted by the management of the Commonwealth Edison Company that cost data on its cars be compiled with accuracy and thoroughness.

Without doubt the greatest factor in the remarkable development of the electric vehicle in Chicago has been the co-operative work of the Commonwealth Edison Company, both in publicly endorsing the electric by conducting its own transportation work by means of electrics and in co-operating with the various agencies, garages, users and prospective users. Weather conditions and the condition of Chicago streets and boulevards have also had an effect on this development.

In the annual report of Mayor Harrison, submitted to the city under date of May 18, 1914, it was shown that of the 2991.41 miles of streets in Chicago, 1759.87 miles were improved, while the remaining mileage was being improved at an average rate of 70 miles per year. The same report showed a total mileage of 1533.81 for alleys, of which 172.15 miles are improved. In addition there are approximately 75 miles of boulevards. The streets and alleys classified as unimproved are periodically oiled and repaired so that but comparatively small amount of streets in Chicago are considered as unfit for automobile traffic.

While the electric, especially the commercial type, is in no sense only a good-road vehicle, it is nevertheless true that the excellence of the street conditions in Chicago has had a stimulative effect on the development of electric-vehicle traffic.

Climatic conditions have also helped, perhaps indirectly, in furthering the development of the industry in Chicago. Although the city is hailed broadcast as an ideal summer resort because of its low average temperature, about 74 degrees for July and August, still the maximum very often reaches 90 to 100 degress and each year hundreds of horses are killed by the heat.

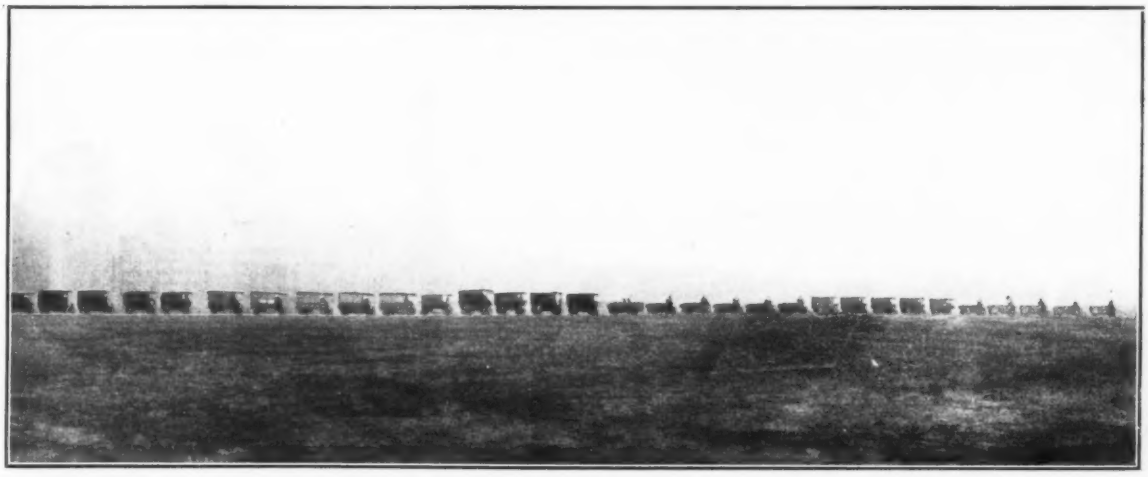
The winters in Chicago are long and usually severe. A glance at the weather report for the past few years shows the mean temperature for December to be 21 degrees, for January 23 degrees, February 17 degrees, and March 27 degrees. These low temperatures are usually accompanied by snow which makes the streets practically impassable for horses. The gasoline vehicle also is greatly inconvenienced in cold weather due to cooling water freezing and trouble in starting. The electric, on the other hand, is unaffected by temperature and negotiates snow and ice-covered streets with little or no trouble.

It is not the intention in this article to comment at any length on the possibilities of the battery-charging load for central stations, but it is entirely appropriate to quote from a paper by William P. Kennedy on electric vehicle problems, to show how fully the Commonwealth Edison Company has accepted the vehicle situation and followed the advice of electric-vehicle manufacturers and others who by reason of their experience are in a position to advise authoritatively.

The potential possibilities of this power consumer as an important factor in the building up of off-peak-period load, while admitted by all, have been aggressively developed by comparatively few and, in fact, are just beginning to attract administrative attention, as worthy of consideration and on a par with the larger elemental influences likely to contribute to future big business extension. In view of the predominant progressiveness of this industry in comparison with others, it is remarkable that so important a projection should remain latent for such a lengthy introductory period, or should be relegated to the minor executive stratum in central-station organizations. Particularly so, when other inferior devices have been seized upon and "boosted" as auxiliary means of stimulating the commercial load-factor.

There can be no denial of the fact that in the past most of the central-station companies have assumed little beyond a passive attitude in extending their organization facilities, in the belief that these were simply means to the ends of the manufacturers. Fortunately this has been changed. The distorted perspective is corrected. We now have a true sense of relations and recognize the fact that the manufacturer's product is, in reality, a means to the central station ends. However, it has required persistent and compelling exertion to justify this final conviction, that vehicle-load development should be undertaken as the much more substantial and permanent accomplishment of implanting upon the commercial circuits of the supply companies a permanent utility for power consumption is perpetuity.

Equally conspicuous in the situation is the survival to date of the handful of courageous manufacturers conducting the strenuous campaign enforced upon them, not only in the conversion and education of their present allies,



Portion of Commonwealth Edison Fleet of Electrics—A Total of 120 are Used.

but in defeating the superior competition of the more popular and extensively exploited gasoline vehicle. Some few have succumbed to the severity of the struggle, but in numbers so small as to attest the rugged, determined character constituting the business fiber back of their project. There is no parallel in any kindred undertaking. Their accomplishments have been monumental and, above all, the tests of the past fifteen years, which have proved that the electric vehicle can be relied upon as one of the staple commodities among the electric utilities now necessary to our modern system of life.

The prospective enterprise of vehicle exploitation on a large scale needs nothing more urgently than administrative effort, exerted cohesively and comprehensively, to place it upon a plane with the major operations of central-station activity and thus give to it the impetus necessary to insure the cumulative return certain to endow its projectors.

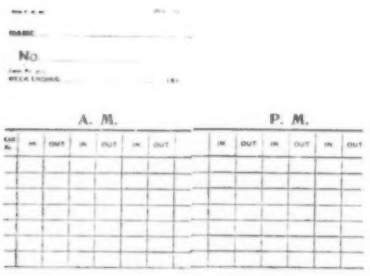


Fig. 3—Drivers' Time Card.

As a business proposition commanding the attention of the captains of the industry conditions could not be more attractive; the grist is on the threshold and the mill has ample power. Evidence of what has been done and can be done is abundant, convincing and conclusive. The indications put forward by the Electric Vehicle Association of America, in its Parcel Post project and the solution more recently suggested for the relief of freight-terminal congestion, are but straws upon the surface of a torrent almost infinitely deep with opportunity.

Under the directive influence of that creative talent which has fabricated our stupendous urban electrical utilities, the facilities of such a powerful machine as the collective centers of energy radiating from the central stations throughout the country could yield a force compelling the almost universal employment of the electric motor wagon in city merchandise transportation and the electric carriage as a domestic convenience and comfort.

We need the superlative administrative genius which has harnessed our natural resources to perform our industrial and community service; that breadth of view which can bridge profit for the brief accelerating period, in anticipation of the fullness of ultimate development; that caliber of judgment which can suppress trivial difficulties and concentrate upon a program of effort against which nothing can possibly prevail.

Fig. 2—Permanent Record for Vehicles.

Electric Vehicles in Commonwealth Edison Service.

Perhaps the one feature which has contributed more to the success of the commercial electric vehicle in Chicago than anything else, has been the concrete endorsement given this type of transportation by the Commonwealth Edison Company. From the beginning, electric vehicle manufacturers and others interested in the welfare of this industry have urged the use of electrics by central stations because of the moral effect on the prospective users. Partially for this reason but mainly on account of the actual economy it was possible to effect, the local Edison company inaugurated the policy of substituting electric wagons and trucks for the horse-drawn type, which will eventually culminate in the disposal of every horse in the service of the company.

The extreme confidence placed in the electric by the Commonwealth Edison Company is appreciated when it is stated that the initial order placed was for nine wagons. These were of the 1.5-ton delivery type, equipped with Westinghouse motors and 40-cell lead batteries, with an average daily capacity of 20 miles. This was in 1900. Today the company operates a fleet of 120 cars and the average daily mileage is approximately 35. It is

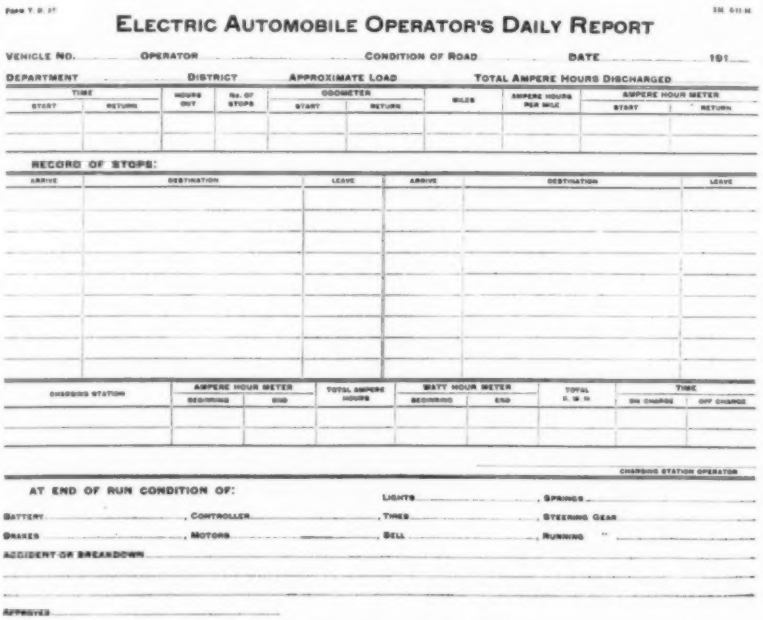


Fig. 4—Operator's Daily Report.

Books on Electric Vehicles

"The Electric Vehicle Hand-Book"

By H. C. Cushing, Jr. and Frank W. Smith

Fellow Am. Inst. Elec. Engrs., Publisher of "The Central Station," the official organ of the Electric Vehicle Association of America.

President Electric Vehicle Association of America and Vice Pres. United Electric Light & Power Co., New York.

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CHAPTERS

I.—Electric Vehicle Development. By William P. Kennedy, Consulting Transportation Engineer.
II.—Lead Storage Batteries; Descriptive Lead Batteries; Charge and Discharge Rates; Care of Storage Batteries.
III.—Care of Lead Storage Batteries; Assembling and Putting New Batteries into Condition; Charging; Charging Overnight; Emergency Charging; Inspection; Electrolyte; Cadmium Readings; Lead Burning.
IV.—Commercial Types of Lead Storage Batteries.
V.—Alkaline Storage Batteries; Description and Care.
VI.—Charging Apparatus and Charging Stations; Alternating Current Apparatus; Isolated Plants.
VII.—Measuring Instruments, Electrical and Mechanical.
VIII.—Wheels, Rims and Tires; Their Care.
IX.—The Motor Construction and Care.
X.—The Controller, Construction and Care.
XI.—The Chassis, Its Components, Their Upkeep.
XII.—Association and Publications Identified With the Development of the Electric Vehicle.
XIII.—Comparative Cost Data.

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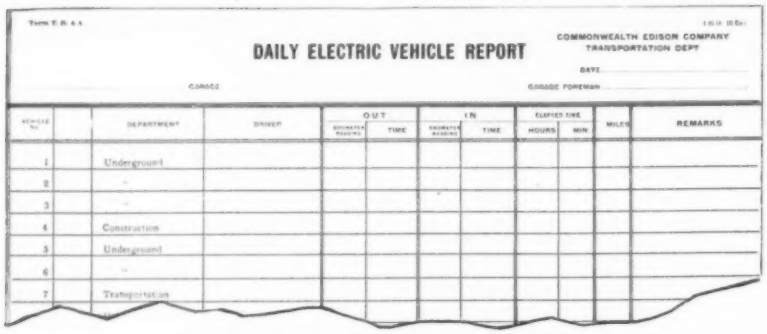


DAILY ELECTRIC VEHICLE REPORT

COMMONWEALTH EDISON COMPANY
TRANSPORTATION DEPT

DATE

GARAGE GARAGE FOREMAN

VEHICLE No.		DEPARTMENT	DRIVER	OUT		IN		ELAPSED TIME		MILES	REMARKS
				AMPERE-HOUR READING	TIME	AMPERE-HOUR READING	TIME	HOURS	MIN.		
1		Underground									
2		"									
3		"									
4		Construction									
5		Underground									
6		"									
7		Transportation									

Fig. 5—Form for Tabulating Daily Performance.

interesting to note, in passing, that with but one exception all of the nine vehicles purchased on the inital order are still in daily service.

With the growth of the company's business and the coincident need for greater transportation facilities, came the need for an organized department to handle the traffic work. In December of 1907, therefore, the Transportation Department was created, with C. F. Clark as superintendent. This department handles the company's business exactly as an outside transfer company would, although it is not intended that a profit or loss should be made. Regular established rates, are maintained for each class and type of vehicle and the charges against each department for transportation are entered against the department receiving the service and credited to the transportation department.

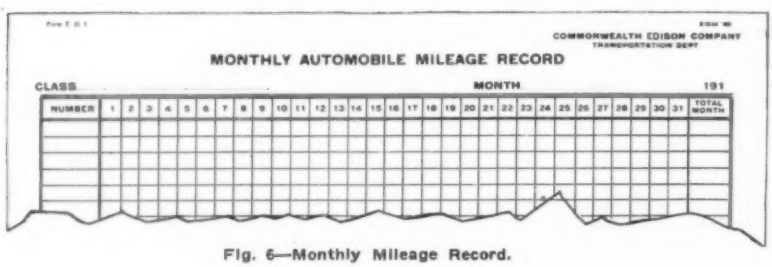
The transportation department has direct and entire charge of the cartage business of the company. Each department of the company is assigned the vehicles which it needs some being specially designed for the work required and these maintained and directed by the transportation department, subject to the orders from the head of the department actually using the vehicles.

The main garage of the Commonwealth Edison Company is located at 210 South Morgan Street, where headquarters of the transportation department are established. District garages are at Fifty-sixth Street and Lowe Avenue, on the South Side and 2745 Lincoln Avenue on the North. Each garage is in charge of a foreman whose duty it is to see that all equipment is kept up to the standard and that employees properly perform the functions required of them. Minor repairs and adjustments are made at the garages, usually at night.

The Commonwealth Edison Company has always taken the position that efficient supervision is essential in the satisfactory conduct of central-station affairs, and this policy is particularly marked in its attitude toward the electric vehicle department. Working on the basis that money spent in this direction is an excellent investment, the company by paying above average salaries, endeavors to secure thoroughly competent foremen and assistants for the various garages. While there is no absolutely definite rate set for those employed in this supervisory capacity, the yearly salary is well above the $1,000 mark.

These foremen are directly responsible for the vehicles and drivers stationed in their garages. They must see that all equipment is kept in the proper order and that the employees perform their duties in the proper manner. They also order all supplies needed and must check over and approve all bills covering equipment for any barn or garage. These foremen report directly to the general superintendent of the transportation department, who in turn reports to the vice-president.

The Morgan Street garage being in the direct-current district, no converting apparatus is required, the equipment consisting of three switchboards controlling 58 circuits. The main board is composed of six panels each controlling five circuits. In each circuit are one Thompson watt-hour meter, one single-pole and one double-pole Lang switch, two General Electric circuit-breakers and Westinghouse resistances. The service panel is provided with Lang switches, Thompson watt-hour meters, Weston ammeter and voltmeter and demand meter. Another switchboard consists of three panels of six circuits each, the panels being equipped in a manner similar to those previously described except that individual Sangamo watt-hour meters are provided for each circuit. A similar single-panel board controlling 10 circuits has recently been installed.



COMMONWEALTH EDISON COMPANY
TRANSPORTATION DEPT

MONTHLY AUTOMOBILE MILEAGE RECORD

CLASS MONTH 191

NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL MONTH

Fig. 6—Monthly Mileage Record.

At the garage located on Fifty-sixth Street provision is made for charging 45 vehicles. There is one 30-circuit switchboard and one controlling 15 circuits, the panels being equipped in the regular manner with individual watt-hour meters for each circuit. The equipment at Lincoln Avenue consists of one 15-circuit board.

In order to ascertain accurately its delivery costs as well as to obtain reliable data with which to promote the use of electrics, the Commonwealth Edison Company has kept elaborate records of performance of every car.

In the first place a permanent record is kept by the transportation department of every car in the service of the company. This record is shown in Fig. 2, a loose-leaf sheet measuring 6 by 11 inches, one sheet being made out for each vehicle.

Fig. 3 shows the drivers' time card which is kept by means of a stamp clock. While the data on this card are primarily for pay-roll records, they also serve as a check on the more elaborate daily reports which are kept by every operator.

One of these daily reports is shown in Fig. 4. The sheet measures 8.5 by 11.5 inches and is held in an aluminum binder with which each driver is provided. The daily report shows the time in and out of the garage, total hours in service, total mileage for the day and ampere-hour readings at start and when vehicle returns. Space is provided for a detailed record of every stop made. This information serves as a check on the driver's time and on the operation of the car but is used primarily in charging the proper departments with the service rendered. If time is consumed in obtaining a charge or boost this is recorded in a space provided.

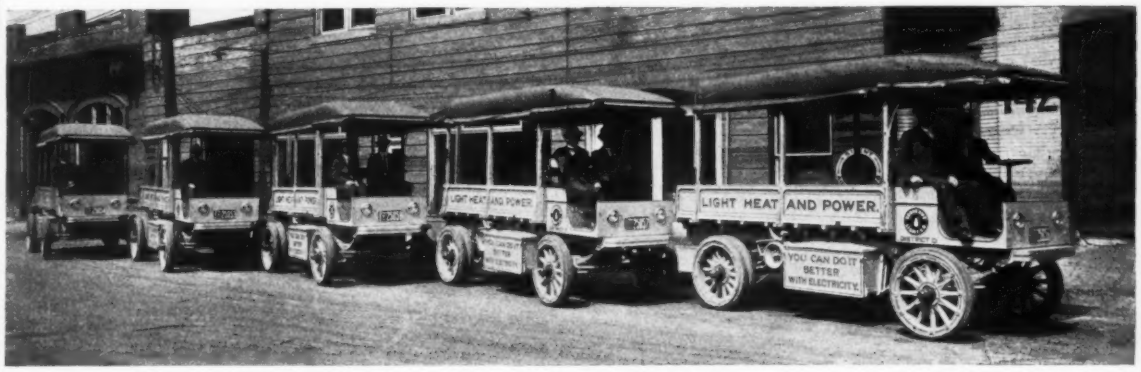
The lower section of the record is intended for a record of the condition of the vehicle at the end of run. When the reports are checked if a report should show the need for adjustments or minor repairs an order is made out to this effect and the work done at night while the vehicle is on charge.

The data from the operators' daily report are then entered on the form

Pittsburg the city of hills adopts

The "Ironclad-Exide" Battery

the efficient and economical battery for any road or any load



One real test for an electric vehicle battery is its ability to give good service at low cost, day in and day out, when used in districts that are very hilly.

The increasing use of the "Exide" Batteries — especially the "Ironclad-Exide" — in and around Pittsburg is very conclusive evidence of the high quality of these batteries, the use of which is growing so rapidly in all parts of the country.

The illustration above is a photograph of 5 two-ton electric trucks recently put in service by the Duquesne Light & Power Co., of Pittsburg, all of which are equipped with "Ironclad-Exide" Batteries.

The Westinghouse Electric & Manufacturing Co., of Pittsburg (undoubtedly an exceptional judge of batteries), also operates 3 electric trucks and 2 electric locomotives equipped with "Ironclad-Exide" Batteries.

The McCreery Co., The Western Pennsylvania Humane Society, The Rosebaum Company, "The Pittsburg Lunch," The Kuhn Co., etc., are a few of the other prominent companies in Pittsburg using "Exide" Electric Vehicle Batteries.

The largest and most prominent Central Stations in the country are large users of "Exide" Batteries.

It's a wise and profitable policy for Central Stations to recommend "Exide" Batteries among the electric vehicle users.

THE ELECTRIC STORAGE BATTERY CO.

Manufacturer of

The "Chloride Accumulator", The "Tudor Accumulator"

The "Exide", "Hycap-Exide", "Thin-Exide" and "Ironclad-Exide" Batteries

New York, Boston, Chicago, St. Louis
Cleveland, Atlanta, Detroit, Rochester
886 "Exide" Distributors

PHILADELPHIA, PA.
1888-1914
10 "Exide" Depots

Denver, San Francisco, Seattle
Los Angeles, Portland, Ore. Toronto
"Exide" Inspection Corps

shown in Fig. 5, which is known as the Daily Electric Vehicle Report. This shows the name of the driver assigned to each car, the odometer reading out and in, the total time car was in service and the total daily mileage. This record is made out in duplicate, one copy being retained by the transportation department and one being sent to the statistical department.

Fig. 6 shows the monthly automobile mileage record on which the mileage of every car is kept. Data for this record are taken from the daily reports and a similar record is kept monthly of the kilowatt-hours used by each car. These data are obtained from the switchboard chart shown in Fig. 7.

The charging record shown in Fig. 7 includes the plug number to which a car is assigned and the kilowatt-hours used in charging each set of batteries. These sheets are made up daily and they form a permanent record of the energy input to each car. In beginning a charge, the double-pole switch on the board is closed and the single-pole switch left open. Current then flows through the ammeter, on the service panel, and an indication of the charging rate is obtained. After the voltage has been adjusted by the resistance, the single-pole switch is closed and the other opened, allowing the ammeter to be used while starting another charge. The readings obtained are recorded on the charging record.

The monthly report of electric vehicles assigned to regular work is shown in Fig. 8. This is a sheet measuring 15 by 11 inches which is made out in duplicate, one copy being sent to the statistical department. In the column marked "Rate" is entered the rate at which the vehicle is charged for in accordance with the schedule mentioned previously. This record is used entirely in the bookkeeping work of the department.

In cases where vehicles are used every day for the same work, as is the case in a number of departments, a monthly requisition is made out. When a wagon is desired for a day or for a trip only the requisition form shown in Fig. 9 is used.

Fig. 10 shows the form used by the statistical department in summarizing electric-vehicle data. These records are final and are obtained from the regular monthly reports submitted to the department. One column is alloted to income, this being figured on the basis previously referred to. These records are made out for groups of vehicles of the same size and type, purchased at the same time.

There are many other miscellaneous records employed in the conduction of the company's transportation business, such as accident reports, requisitions for material and supplies, work orders, etc. These, however, are only incidental to the principal records just described.

It has been stated that the Edison company uses 120 electric vehicles in its own service. This figure includes four heavy trucks used in special work, but not the five electric passenger cars in use which would bring the total figure to 125. Of the 120 cars, 100 are regularly in service assigned to the various departments and 10 are kept in reserve for emergency and to take the place of vehicles in the shop.

The overhead-construction department regularly uses 23 vehicles of the Walker type, each of a capacity of 3,000 pounds. The vehicles average 20 miles per day and because of the peculiar requirements of the service, are equipped with special bodies. Drawers and compartments for holding materials and tools are provided along the sides of the body in such a way as to permit of easy access and at the same time afford the necessary protection. A place is provided for each tool and each class of material so that the driver, who acts as groundman, can immediately lay his hands on any desired tool. The use of these vehicles has effected marked savings in construction and repair work.

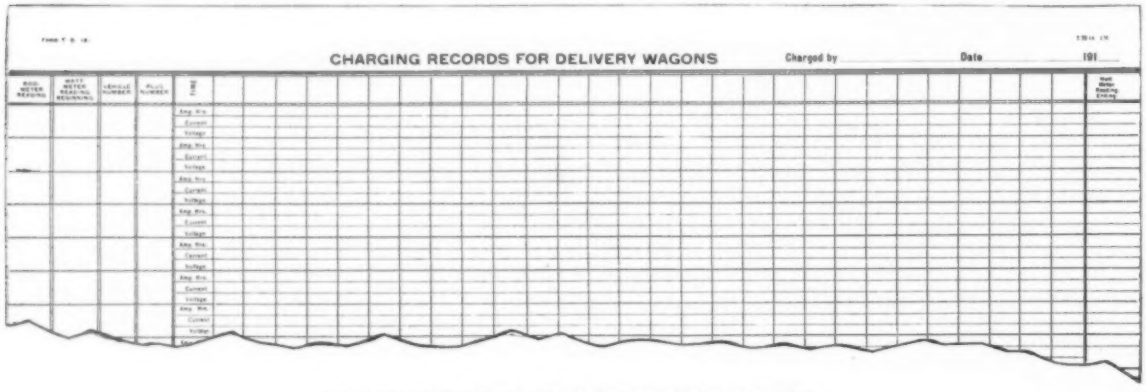
The street department uses a total of seven vehicles. Three of these are used for ordinary delivery work such as hauling sand, cement, pipe, conduit, etc., to the various jobs and one is held as an emergency rig subject to call at any time of day or night, especially for manhole trouble. The three general utility vehicles average 35 miles per day. One is of General Vehicle manufacture, of two tons capacity and two are of Walker Vehicle manufacture, of 3000-pounds capacity. The emergency truck is also a 3000-pound Walker, averaging 20 miles per day.

In addition, there are three 3000-pound Walker trucks equipped with motor-driven winches for pulling cable through conduit. One of these electric winches is capable of pulling 3000 feet of 250-circular-mil three-conductor cable in a day, or when running it can handle about 30 feet of cable per minute. In addition to cable pulling these vehicles haul the men and tools to the job and saved considerably over the former horse-drawn equipment. The average daily mileage of these trucks is 20.

In the customers' repair department two 3,000-pound Walker trucks are used to convey material from the general store room to the various distributing stations, a daily trip for each vehicle of about 40 miles. Nineteen 1,000-pound wagons, seven of General Vehicle make and 12 of Walker make, take this material from these distributing stations to the destinations where needed. Each of these wagons average 35 miles per day.

The Electric Shop, handling retail merchandise, regularly employs two 3,000-pound Walker vehicles which cover the entire city and run as high as 50 miles per day.

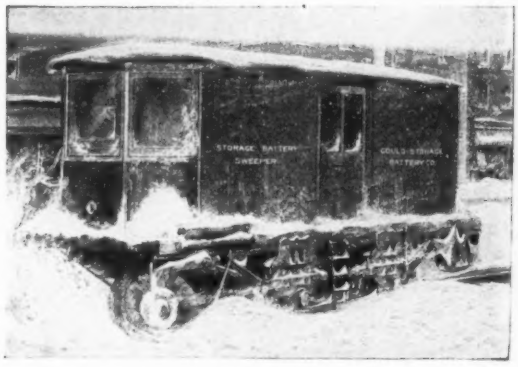
One 3,000-pound Walker is used by

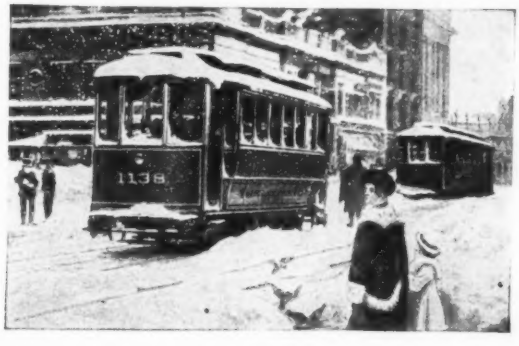

CHARGING RECORDS FOR DELIVERY WAGONS

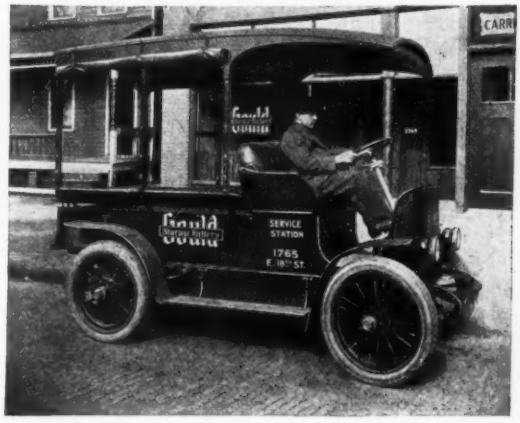
Charged by _____ Date _____ 191__

Fig. 7.—Charging Record Kept by Switchboard Attendant.

What Gould Vehicle Batteries Are Capable of Doing







Average electric vehicle service is easy compared with what Gould Battery Cars did last winter in snow-bound New York, when the heavy snows of February 28 to March 3 paralyzed underground conduit cars all over the city. In this very severe test Gould Battery Cars of the Third Avenue Railway Company never faltered. Their operation was so reliable that they were temporarily brought to the rescue of other lines handling heavier traffic.

Gould Storage Batteries for propulsion of electric pleasure and delivery vehicles are equipped with the same type of plates that made these phenomenal records in street car service. And our vehicle batteries are in every way provided with the newest construction for convenience, long life, power economy and extreme operating radius.

Our booklet, "What Gould Vehicle Batteries Are Doing," gives performance records and other information that every electric vehicle man can profitably investigate. Ask for a copy.

Gould renewals fit jars of any make.

Gould Storage Battery Co.

General Offices: 30 E. 42nd St., NEW YORK CITY **Works: DEPEW, NEW YORK**

BOSTON: 14-16 Cambria St. PHILADELPHIA: 613 Betz Bldg. CLEVELAND: 1761-5 E. 18th St.
DETROIT: 88 E. Congress St. CHICAGO: 225 E. 22nd St.
SAN FRANCISCO: 1448 Van Ness Ave. LOS ANGELES: 110 E. Pico St.

Agents in Washington, Rochester, Buffalo, Pittsburgh, Milwaukee, Minneapolis, St. Louis, Kansas City, Omaha, Denver, Topeka, Seattle
Canadian Representative: R. E. T. PRINGLE, Toronto, Montreal, Winnipeg, Vancouver

COMMONWEALTH EDISON COMPANY
TRANSPORTATION DEPT

MONTHLY REPORT OF VEHICLES ASSIGNED TO REGULAR WORK.

MONTH.

DATE	REG. NO.	VEHICLE NO.		NAME OF WORK	RATE	TOTAL COST	CHARGE TO ACCT.	CHARGE TO AMOUNT	REMARKS

Fig. 8—Monthly Operating Report of Electric Vehicles.

the repair shops and five cars of the same type and capacity are assigned to the transportation department. The latter are used for miscellaneous haulage and average 30 miles per day.

The lamp-exchange department employs a total of 16 vehicles of the following sizes and make: One 1,000-pound Ward; one 1,000-pound Waverley; five 1,000-pound Walker; two 1,500-pound Studebaker; three 1,500-pound General Vehicles and four 1,500-pound Walker. These vehicles are all of a specially designed type, so arranged as to facilitate handling the lamps and making replacements with a minimum number of breakages. Iron shelves are provided along the sides on which special boxes fit. These boxes are provided with 50 pasteboard compartments, each of a size sufficient to take an incandescent lamp snugly. The average number of lamps renewed average daily mileage per rig is approximately 40.
average daily mileage per rig 40.

Six 1,000-pound Walker wagons and three of 1,500 pounds' capacity are used by the arc and sign department for delivering street lamps, electric signs and sign materials. These vehicles average about 35 miles per day.

The stores department uses 16 cars, nine of Walker manufacture, 3,000 pounds capacity, and seven General Vehicle of 4,000 pounds' capacity. These vehicles handle all kinds of material for new installation work and general merchandise for delivery to customers. The average daily mileage is 45.

For general haulage of heavy loads from freight stations, etc., two trucks are employed. One is a five-ton truck of overhead construction; one car of facture and one a 3.5-ton Walker. One 3.5-ton Walker and one 3.5-ton General Vehicle truck, each equipped with motor-driven winch, are employed for handling heavy machinery, reels of cable, transformers, etc.

Five electric passenger cars are also used by the Commonwealth Edison Company. One two-passenger Bailey roadster is used by the superintendent of overhead construction; one car of same make and size is used by the superintendent of the street department; and one by the trouble department. A four-passenger Bailey is used by the substation department and the contract department uses a three-passenger Detroit electric in its new-business work.

Activities of Edison Company in Promoting Use of Electrics.

While the Commonwealth Edison Company has been an ardent advocate of the electric vehicle since the economies of its own initial installation were demonstrated, about 14 years ago, the last few years has witnessed a concerted and comprehensive campaign to increase the number of electrics in Chicago. For this work the company has been handsomely repaid, as the annual revenue from vehicle battery charging alone amounts to $365,000.

One of the chief factors in the cooperative work of the Edison Company, is its electric-vehicle department, maintained solely for the purpose of stimulating sales of cars, both passenger and commercial, and to advise and consult with prospective users and garages. The department is composed of three men, experts in their lines, and is in direct charge of George H. Jones,

COMMONWEALTH EDISON COMPANY
TRANSPORTATION DEPT.

REQUISITION FOR VEHICLE No. 17845

Ordered by _____ Date _____
Order Received by _____ Credit to _____
Nature of Work _____
Number of Vehicle _____ Name of Driver _____
Charge to _____ Date and Time Sent Out _____
Approved by _____ Date and Time Returned _____
_____ Total Time Out _____
Rate per Hour _____ Total Cost _____
Remarks: _____

This Requisition Must be Approved by Proper Authority and Sent to the Statistical Department Without Delay.

Fig. 9—Requisition Form Used in Ordering Vehicles.

power engineer of the company. In addition to this department the company maintains a rectifier repair department to handle all repairs and trouble with garage or private equipment. This department renders free service to all customers of the company and charges are only made when new parts have to be supplied or material purchased.

One of the functions of the vehicle department is to maintain harmonious relations with the various garages and to adjust differences that frequently arise between user and garage owner and even between garages. It is the duty of one representive of the department to call on every garage at least once in 60 days, and on these visits data are compiled on the operation of the garage, number of cars handled, etc. Recently the company presented to every garage owner a copy of the Smith and Cushing electric vehicle data book. The underlying object of this step was to present the garage oper-

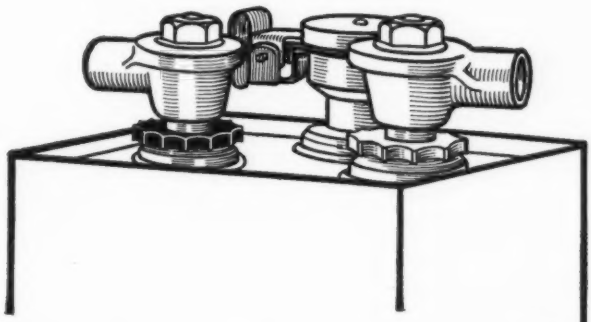
WALKER VEHICLE COMPANY WAGONS. MODEL A, 3000 Lbs. CAPACITY, LEAD BATTERIES REBUILT YEAR 1906. NO'S. 1-11 Inclusive

1914	Uniforms Supplies Etc.	Tire Repairs and Replacements	Battery Repairs	Painting	Vehicle Repairs	Vehicle Wheel Tire	Washing and Placing Vehicle on Charge	Garage Building Maintenance	Transportation on Vehicle	Depreciation on Vehicle	Total Cost	Cost Per Day Mile
JANUARY												
FEBRUARY												
MARCH												
APRIL												
MAY												
JUNE												
JULY												
AUGUST												
SEPTEMBER												
OCTOBER												
NOVEMBER												
DECEMBER												
TOTAL												
AVE. PER MO.												
AVE. PER MILE												
PREVIOUS												
TOTAL TO DATE												
AVE. PER MO.												
AVE. PER MILE												

1914	Total Mileage	Energy in K.W.H.	K.W.H. per Mile	Total Days in Service	PER VEHICLE Days in Service	PER VEHICLE Miles	PER VEHICLE K.W.H.	Number of Vehicles Total	Number of Vehicles in Service			INCOME
JANUARY												
FEBRUARY												
MARCH												
APRIL												
MAY												
JUNE												
JULY												
AUGUST												
SEPTEMBER												
OCTOBER												
NOVEMBER												
DECEMBER												
TOTAL												
AVE. PER MO.												
AVE. PER MILE												
PREVIOUS												
TOTAL TO DATE												
AVE. PER MO.												
AVE. PER MILE												

Fig. 10—Permanent Record Kept by Statistical Department.

TRADE MARK
Thomas A. Edison



The Electric Truck equipped with Edison Batteries has

1460

Edison Days

of Guaranteed

100 Per Cent Capacity

EDISON DAY, Oct. 21

is the 35th Anniversary of the Invention of the Edison Incandescent Lamp

The Edison Storage Battery

is as great an advance in World Progress as was the Edison Lamp, and is today as far ahead of competition as

"The Sun's Only Rival"

Power

Strength

Reliability

Permanence

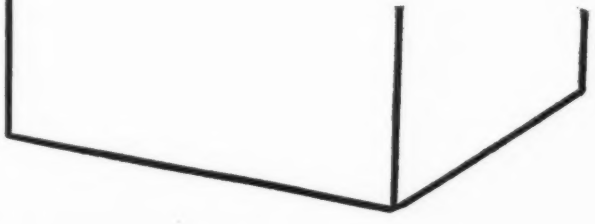
THE EDISON NICKEL-IRON-ALKALINE Guaranteed Battery

Made by the

Edison Storage Battery Co.

Main Office and Factory, Orange, N. J.

Distributors in New York, Chicago, Boston, Cleveland, Washington, Baltimore, San Francisco, Los Angeles, Portland, Ore., Seattle



ator with information that would help to raise the standard of garage practice.

The vehicle department is well versed in transportation matters and is often called in an advisory capacity by prospective users of commercial cars. All information possible is also given to prospective passenger car users or to those having trouble or desiring information.

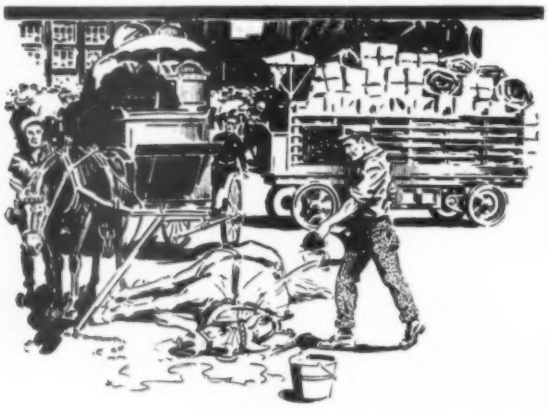
It is of course impossible to ascertain just how many sales have been influenced by the Edison company, but it is certain that much of the credit for the stimulus given the sales of electric vehicles is due to the advertising and publicity efforts of the vehicle department. The Commonwealth Edison Company, always a liberal user of newspaper space, has consistently bought advertising to impress on both the possible user, and the public in general, the economy, convenience and advertising value of the electric. In addition to this, large illuminated billboards were used for a period of several months, 25 of these being used at various points on the boulevards and elsewhere.

A handbook for electric vehicle users was one of the important items in the company's publicity campaign. This book designed for users of both commercial and passenger cars, contains general rules and instructions for the operation and maintenance of the car; data on the charging and care of storage batteries; form for keeping opering records; how to estimate bills; read meters and other miscellaneous features. A valuable feature of the book is a map of Chicago showing the location of the charging stations with relation to the boulevards and streets. A map of the suburbs is also given, showing the charging stations of the Public Service Company of Northern Illinois.

As the charging and garaging facilities for the commercial vehicle in Chicago are not adequate, the Commonwealth Edison Company, realizing that the ultimate development of the electric depends in a large measure on the opportunities afforded the user for convenient charging, decided to provide emergency facilities at its various substations. At the present time 21 substations are so equipped, these being shown in the accompanying table.

Two of the stations in this list are garages where the company's own cars are charged and kept. At the Morgan Street garage facilities are provided for testing batteries and vehicle instruments. This service is free to customers of the company. The rate for battery charging at the various substations is five cents per kilowatt-hour with a minimum charge of 25 cents.

Although the cost of energy is but a small part of the cost of operating an electric vehicle, the Edison company



Heavy Heat Kills Scores of Horses

Each year, the heavy heat of summer, daily kills thousands of dollars worth of valuable horseflesh. During protracted spells of torrid weather, even the healthiest horses often succumb. Why run the risk of such an occurrence in ***your*** business? Electric Commercial Vehicles provide an easily-obtainable insurance against this loss.

Electric Trucks Defy All Sorts of Weather

Recent records show that more and more big business concerns are realizing the superiority of Electrics for city haulage. Day or night—regardless of extremes of weather—Electrics will work for you efficiently and cheaply. The economy of Electrics averages from 10% to 25%—and, besides, their trim, neat appearance has immense advertising value which costs you nothing.

Our vehicle expert is freely at the service of interested business men. 'Phone Randolph 1280 today.

Commonwealth Edison Company
120 West Adams Street

Wm. D. McJunkin Advertising Agency, Chicago 1918

Fig. 11—Typical Commercial-Vehicle Newspaper Advertisement of the Edison Company.

¶The Electric has proved its case. If you want the acme of comfort and convenience at minimum expense, you should own a safe, simple Electric.

¶The exhibits of Electric Vehicles at the Automobile Show are achievements of mechanical perfection and beauty of design. Be sure to visit them.

The services of our Electric Vehicle expert are gladly extended to those interested. Just call Randolph 1280.

Commonwealth Edison Company
120 West Adams Street

Wm. D. McJunkin Advertising Agency, Chicago

Fig. 12—One of a Series of Passenger-Car Advertisements During Automobile Show.

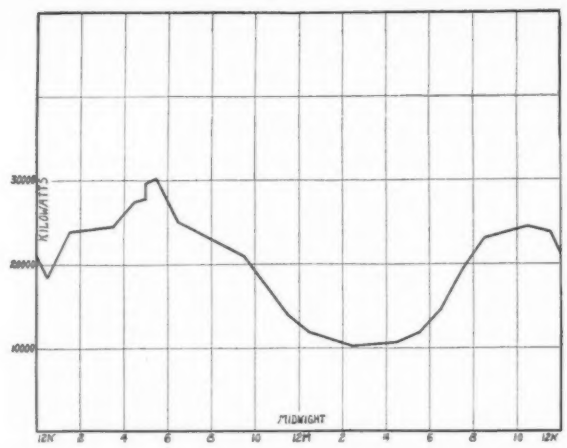


Fig. 13—Total Load Diagram of a Large Central Station Showing Night Valley.

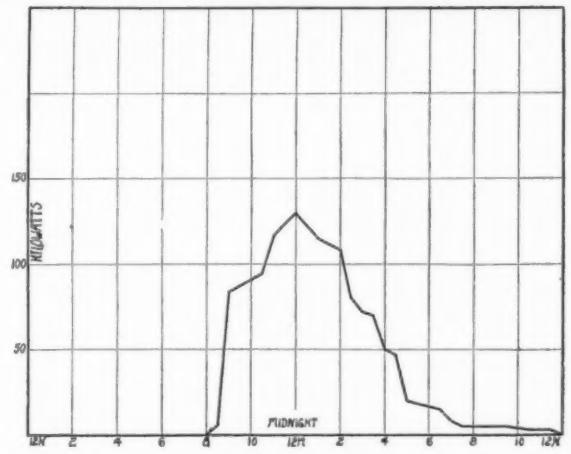


Fig. 14—Load Diagram of Vehicle-Battery Charging Showing Off-Peak Characteristics.

has adhered to the policy of reducing rates periodically. Energy rates for the private user are as follows: 11 cents per kilowatt-hour for electricity used equivalent to or less than the first 30 hours' use per month of the maximum demand in the month; 6 cents per kilowatt-hour for additional electricity used equivalent to or less than the first 30 hours' use per month; 6 cents per kilowatt-hour for additional electricity used equivalent to or less than the next 30 hours use per month of the maximum demand; and 4 cents per kilowatt-hour for all electricity used per month in excess of the equivalent of 60 hours' use of the maximum demand. In addition to a discount of one cent per kilowatt-hour for the total consumption the customer is allowed an additional discount in accordance with a definite schedule.

The company also offers an off-peak rate for public garages. The customer guarantees that his maximum demand in any month shall not be less than 50 kilowatts, for which a monthly charge of $1.40 per kilowatt is made and 75 cents per kilowatt per month for the excess of the maximum demand. In addition to this an energy charge based upon the number of kilowatt-hours consumed is made in accordance with the following schedule:

Commonwealth Edison Company Emergency Electric-Vehicle Charging Stations.

Substations.	Capacity, Amperes.
Ardmore Avenue	40
Ravenswood	40
Whipple Street	40
Lake View	60
West Division Street	30
North Clark Street	50
Kolmar Avenue	200
Harding Avenue	40
West Madison Street	40
Troy Street	40
Hermitage Avenue	40
Morgan Street Garage	60
Grove Street	60
21st Street	40
27th Street	50
Hyde Park	60
56th Street	200
62nd Street	40
Grand Crossing	200
South Chicago	200
Roseland	200

5 cents per kilowatt-hour for the first 1,000 kilowatt-hours of consumption in the month; 3 cents per kilowatt-hour for the next 4,000 kilowatt-hours; 1.1 cents per kilowatt-hour for the next 25,000 kilowatt-hours; 0.9 cent per kilowatt-hour for the next 70,000 kilowatt-hours; 0.65 cent per kilowatt-hour for the excess consumption in the month over 100,000 kilowatt-hours.

The minimum charge is figured on a yearly basis and is especially advantageous to users whose vehicles are not in service during certain months of the year. These charges or guarantees are as follows:

	Per Year.
20-ampere rectifier or direct-current board	$24.00
30-ampere rectifier or direct-current board	36.00
40-ampere rectifier or direct-current board	48.00
50-ampere rectifier or direct-current board	60.00

Energy is supplied to the public garages at the company's regular wholesale power rates with the following special provision: The electricity to be furnished shall be used in the customer's premises (being a public garage) for the purpose of charging automobiles, and for no other purpose. The customer agrees not to use any electricity during the period of time between the hours of 4:30 p. m. and 8:30 p. m. of each day in the calendar months of October and February and between the hours of 4:00 p. m. and 8:30 p. m. of each day in the calendar months of November, December and January, and in consideration of such

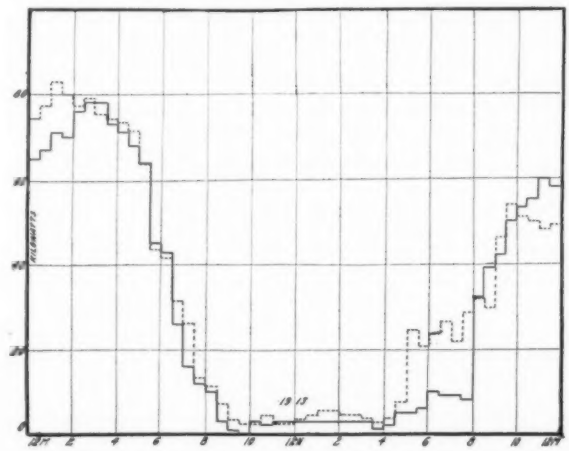


Fig. 15—Load Curve of Passenger-Car Garage.

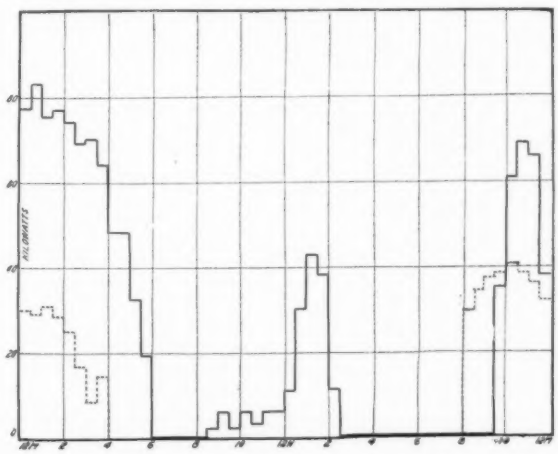


Fig. 16—Load Curve of Commercial-Car Garage.

agreement on the part of the customer the company agrees that the customer's net rate for electricity furnished shall not exceed four cents per kilowatt-hour; provided that in no case shall the net charge hereunder for any month be less than the minimum monthly charge specified.

Electric Vehicle Garages in Chicago.

Exclusive of the substations of the Commonwealth Edison Company there are at the present time in Chicago 74 garages caring for electric vehicles. These range from the large modern institutions to the small garage devoting a section to electric vehicles, but deriving most of their income from caring for gasoline cars. There are but few public garages for commercial cars, these usually being kept by the user, while the passenger car garages care for 2,117 of the 3,000 electric automobiles in Chicago. Of the 74 garages, 69 purchase power from the Commonwealth Edison Company. The value of this business to the company is graphically shown in the accompanying curves.

In the first place, Fig. 13 is the total load diagram from a large central station. Usually load diagrams representing one day's operation commences and ends at midnight. When a day's operation is shown by a curve commencing and ending at noon, the off-peak valley is shown by a continuous line and more clearly illustrates the enormous extent of this valley. Fig. 14 is a load diagram of vehicle battery, charging and if this is superimposed on the curve in Fig. 13, some idea of the value of this business is obtained.

The daily load curves of two garages one handling passenger cars and one commercial cars are shown in Figs. 15 and 16.

Perhaps the best example of modern practice in public passenger-car garages will be found in the Fashion Garage at Fifty-first Street and Cottage Grove Avenue, Chicago. This garage which was completed about a year ago was described in our issue of September 6, 1913, but a repetition of some of the data may be of interest here. This garage handles electrics exclusively, space and equipment being provided to charge 120 vehicles at a time.

The building is of ornamental brick and reinforced concrete, with a steel roof, making it absolutely fireproof. It is one story high and comprises two wings, forming an L. The section running north and south, facing Fifty-first Street, measures 130 feet by 180 feet, while the section fronting on Cottage Grove Avenue, running east and west, measures 50 feet by 180 feet. The office is located at the junction point of the two sections and also being L-shaped permits of an unobstructed view of the entire building.

A total of 34,800 square feet of floor area available for handling cars and the Fashion garage is now one of the two largest in the world devoted exclusively to electric vehicles.

The Fifty-first Street wing, having an area of 23,400 square feet, is divided into three bays by bumpers in which the charging circuits are imbedded. A view of the central bay is shown in Fig. 17.

A model switchboard of nine panels is located in the center of the room, accessible from any location. There are eight charging panels, each equipped with new type carbon-compression rheostats made by the Allen-Bradley Company of Milwaukee. The resistance in these rheostats is secured through the imperfect contact between the surfaces of prepared graphite disks, piled in a column. This contact resistance varies with pressure and the resistance changes are caused by subjecting the column to various degrees of pressure. The columns of disks are inclosed within an insulated steel tube, which is provided with suitable terminals and plungers for transmitting the pressure to the disks. As the resistance of these rheostats is not varied by cutting in and out resistance units, by

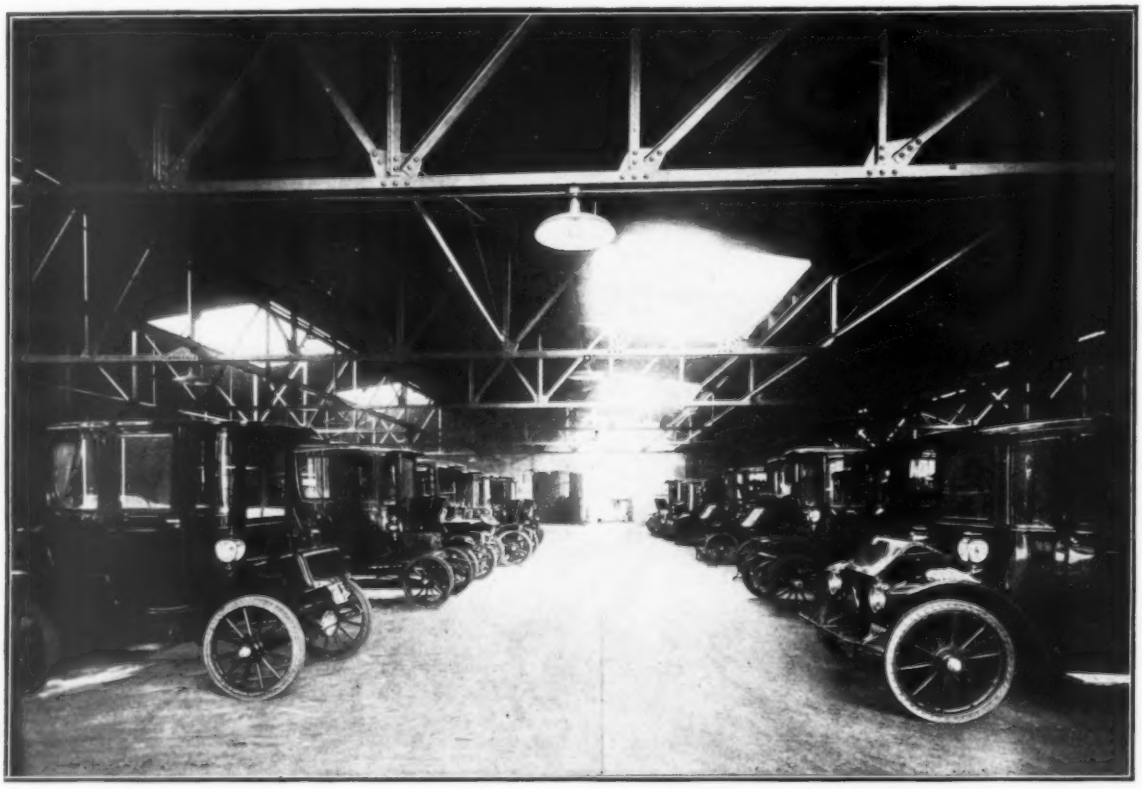
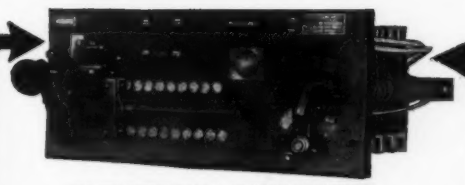


Fig. 17.—Central Bay of Fashion Garage, Chicago.

CUTLER-HAMMER

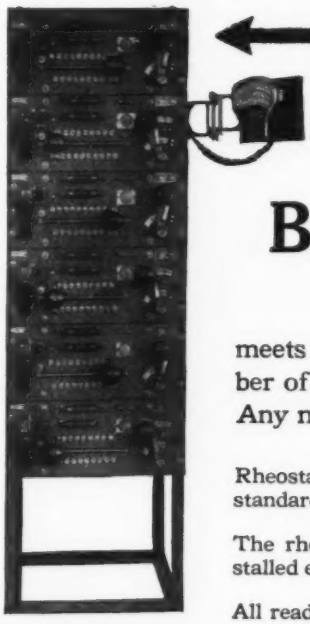
Provide for Future Growth

The latest development of the Cutler-Hammer engineers—the Unit Type Battery Charging Rheostats, can be assembled like a sectional bookcase. Whether you install a big outfit or a few rheostats at a time, the final result will be the same.



EACH SECTION A COMPLETE UNIT

Each charging rheostat with its resistance is a complete, easily handled unit, 24 in. wide, 10 in. high and 20 in. deep. New sections can be added as easily as sections of a sectional bookcase.



Six Unit Type charging sections mounted on standard frame.

New Universal Unit Type Battery Charging Equipment

(The Sectional Bookcase Idea)

meets the requirements of the small and large garage alike. Any number of single charging units up to six can be mounted on a standard frame. Any number of frames can be mounted side by side.

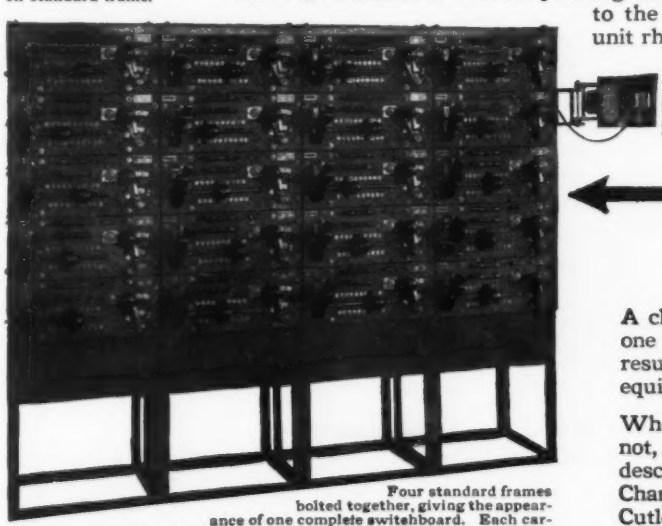
Rheostats or frames can be added like sections of a sectional bookcase. Everything is standardized and every convenience—every safeguard—is provided.

The rheostats are all within easy reach for operation without rods. They can be installed easily and quickly, and the connection arrangements on the back are very simple.

All readings may be taken without opening the charging circuit.

There is no chance of error in operating the wrong rheostat as the sliding handle is adjacent to the controlling switch of the rheostat and each unit rheostat is complete in itself.

The result of our long experience in the design of charging rheostats is expressed in this new unit type charging equipment.



Four standard frames bolted together, giving the appearance of one complete switchboard. Each carries five charging sections mounted with a blank space for at the bottom.

Additions Easily Made

A charging outfit of several panels may be installed at one time or during the course of several years. The result will be the same. You will have a uniform equipment installed in the smallest possible space.

Whether you need battery charging equipment now or not, you should have a copy of Bulletin 8530 which describes and illustrates this new Universal Unit Type Charging Equipment, the latest development of the Cutler-Hammer engineers.

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK: 50 Church Street CHICAGO: Peoples Gas Bldg. PITTSBURG: Farmers' Bank Bldg. BOSTON: Columbian Life Bldg.
PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Building CINCINNATI: Gwynne Building
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St., SAN FRANCISCO. San Fernando Bldg., LOS ANGELES and Morgan Building, PORTLAND, ORE.

Fig. 18—Switchboard and Motor-Generator Set in Private Commercial-Vehicle Garage.

Fig. 19—One Section of the Garage of Marshall Field & Company, Chicago.

means of a contact arm and segments, but is dependent upon the pressure applied, the current may be set exactly at any desired value, regardless of the number of cells being charged, and may be raised gradually.

The center panel of the switchboard is equipped with main line switches and a watt-hour meter for measuring the energy used. A Printometer is also installed for furnishing a printed record of the energy used at specified time intervals, this record being used by the Commonwealth Edison Company in ascertaining the time of maximum demand. A special direct-current line from the Edison Company's Hyde Park substation was built by the garage this insuring a high grade of service and eliminating the danger of inattention or inexperience in operating motor-generator sets at the garage.

All charging circuits are run in conduit under the cement floor. The wiring for light and power is also run in conduit between the walls. Universal charging plugs of the Anderson swivel type are used exclusively.

In the northeast corner of the Fifty-first Street section there is located a fully equipped machine shop and trim shop where repairs of any extent can be made. In fact, it is possible to completely rebuild a car with the equipment installed. The machines, comprising two lathes, two drills, shaper, emery wheel, etc., are driven by a five-horsepower motor which also drives an air compressor supplying air to tires. In the trim shop all work is done by hand.

The extreme north end of the garage is equipped as a battery room, where batteries can be built, tested, repaired and cleaned. Distilled water furnished by an automatic distilling equipment is used exclusively in flushing batteries.

The space south of the battery room is utilized as a wash room, two automatic washers being installed overhead. When cars are being washed a downward pressure is exerted on the hose suspended from the washers. By releasing hose the water supply is cut off. A portable electric vacuum cleaner, mounted on a truck, is used for cleaning car interiors.

The lighting of the Fashion garage is worthy of particular mention as it closely follows the most exacting specifications for illumination of this class of interior. A total of 150 100-watt tungsten-filament lamps equipped with white-enameled steel reflectors are suspended from the ceiling, spaced uniformly so as to give well distributed light over all parts of the building. No localized lighting is needed in any part of the main charging room. Natural lighting has also been given a maximum of attention, numerous skylights being cut in the roof.

A word as to organization and management at the Fashion garage. As service is the commodity sold, no detail is overlooked in giving the utmost care and attention to cars. One man is employed who devotes his entire time to inspecting and testing batteries and regardless of tests all batteries are flushed 2 to 3 times each month. Another employee devotes his entire time to aligning wheels and making minor

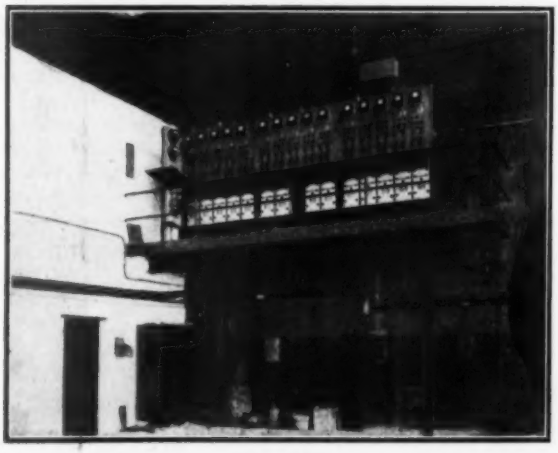
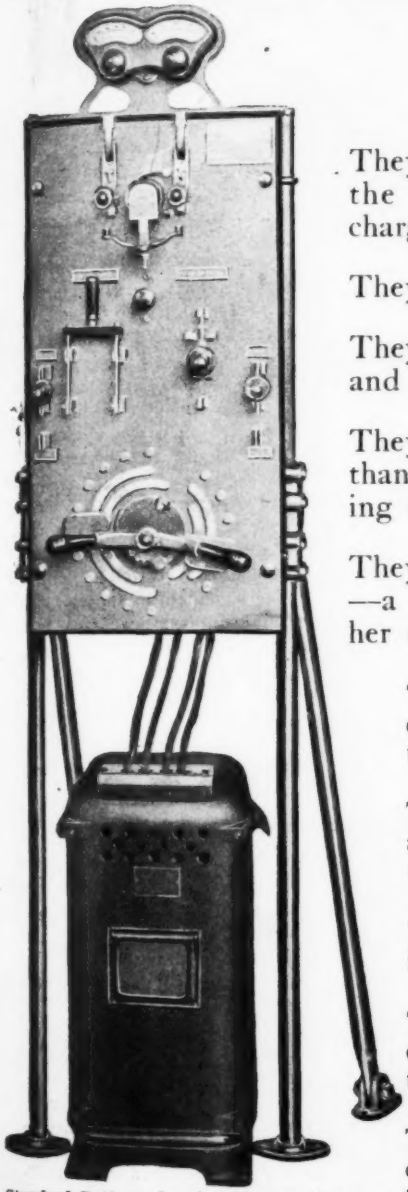


Fig. 20—Typical Switchboard Installation in Chicago Garage. Meter to Each Circuit.

Fig. 21—Portion of Electric Fleet of Marshall Field & Company at Garage.

This Trade Mark The Guarantee of Excellence on Goods Electrical.

Over 12,000 Mercury Arc Rectifiers used because



Standard Battery charging Mercury Arc Rectifier

They are acknowledged to be the most satisfactory for charging electric automobiles.

They have no moving parts.

They require no oil or grease and therefore always clean.

They have a higher efficiency than any other type of charging device.

They are simple and complete—a woman can easily charge her own electric.

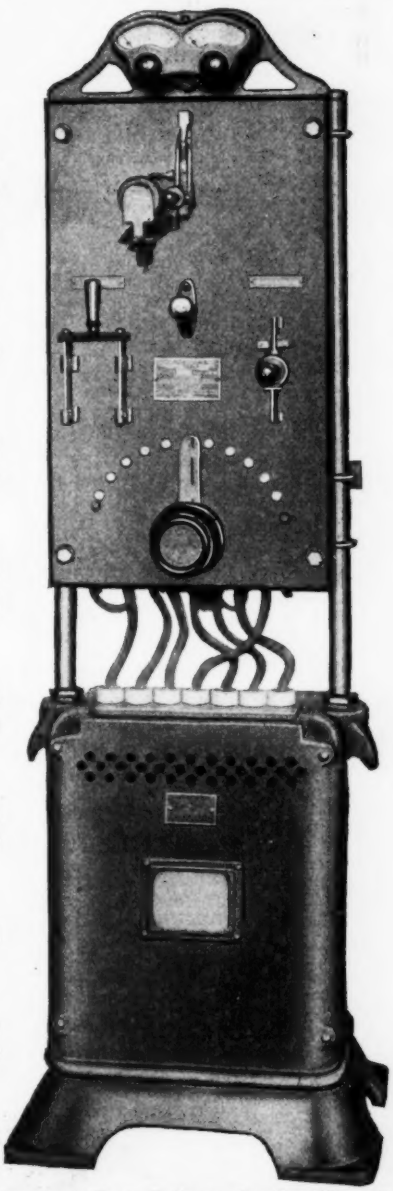
They save the trouble and expense of frequent trips to the garage.

They are more easily installed and cost less than any other reliable charging device.

They take up very little room in the garage.

They are highly recommended by thousands of enthusiastic users.

They are kept in stock in 14 district warehouses, ready for immediate shipment.



Runabout Type Battery charging Mercury Arc Rectifier

General Electric Company

General Office, Schenectady, N. Y.

Sales offices in all large cities

5219

This Trade Mark The Guarantee of Excellence on Goods Electrical.

COMMONWEALTH EDISON COMPANY'S ELECTRIC DELIVERY WAGON COSTS.

	Total Expense.	Cost Per Vehicle Per Year.	Cost Cents Per Mile.
Painting	$ 2,193.77	$ 29.41	0.5
Tire replacements	6,377.28	79.71	1.3
Supplies	1,734.67	21.71	0.3
General repairs	19,663.52	245.85	4.0
Battery repair	10,903.83	136.30	2.2
Washing and charging	7,548.37	94.35	1.5
Maintenance of garage, including rental	13,113.86	163.92	2.7
	$61,540.30	$771.25	12.5
Average number of cars	80		
Average number in service	67.5		
Operating and repairs as shown above		$ 771.25	12.5
Energy @ 4c (1 KW. H. per mile)		290.12	4.0
Driver's salary		780.00	10.7
Supervision		54.00	.7
Wheel tax and state license		30.00	.4
Depreciation		240.00	3.3
Interest, taxes, insurance		100.00	1.3
		$2,265.37	32.9
Average miles per vehicle per Year		7253	

CARS ON WHICH FIGURES ARE BASED.

Number.	Capacity.	Average Age in Months Dec. 31, 1913.
2	700	30
2	750	15.5
22	1,000	7.5
10	1,500	30.2
4	2,000	45.5
45	3,000	38.6
9	4,000	18
94	Average 1,850	Average 26.5

adjustments. In addition there is, of course, a day crew and night crew in charging room, machine shop, battery room, wash room, etc. As each car leaves the garage it is given a thorough inspection by an inspector stationed at the exit.

A typical commercial-car garage is that of Marshall Field & Company, located on Sixty-third Street. The equipment here comprises two 50-ampere General Electric Company rectifiers and one 75-kilowatt motor-generator set. Another motor-generator set is now being installed. The charging equipment comprises four circuits of from 10 to 150 amperes capacity and 16 circuits of from 10 to 60 amperes capacity. The switchboard is of Schaefer manufacture and all circuits are equipped with individual watt-hour meters.

Co-Operation of Vehicle Interests.

In discussing the electric vehicle situation in Chicago and commenting on the development locally, full credit must be given the Chicago section of the Electric Vehicle Association of America for its stimulative influence and its activities in bringing together the various interests concerned in the electric vehicle.

Papers of educational value are presented and discussed at the regular meetings and questions of vital interest are decided. In the same connection the activities of the Chicago Garage Owners Association and the Chicago Motor Club should be mentioned, the latter organization being particularly concerned with the improvement of road conditions.

RECAPITULATION OF CHICAGO ELECTRIC VEHICLE STATISTICS WITH REFERENCE TO COMMONWEALTH EDISON COMPANY'S ACTIVITIES.

	1914.
CHARGING STATIONS.	
Number electric vehicle garages in Chicago (exclusive of private charging boards and Edison substations)	74
Number electric vehicle garages on Edison service	69
Number electric vehicle garages having isolated plants	4
Number private alternating current rectifiers on Edison service	603
Number private direct current charging boards on Edison service	132
Total number charging stations (private) on Edison service	735
ISOLATED PLANTS.	
Number garages having isolated plants or purchasing outside energy	4
Total generating capacity, kilowatts	203
Estimated kilowatt-hour output per month	45,000
COMMERCIAL CARS.	
Total number commercial cars in Chicago	761
Total number charged on Edison service	638
Total number charged on outside power	123
Total kilowatt-hour consumption-trucks on Edison service (including Edison trucks)	330,000
Average kilowatt-hour consumption per truck per month—Edison service	517
PLEASURE CARS.	
Total number pleasure cars in Chicago	3,000
Number pleasure vehicles charged in public garages—Edison service	2,000
Number pleasure vehicles charged in private charging stations	735
Number pleasure vehicles on isolated plants	117
Number pleasure vehicles estimated in storage or unaccounted for	148
Total monthly kilowatt-hour consumption pleasure vehicles—public garages on Edison service	600,000
Average kilowatt-hours per car per month in public garages on Edison service	300
Total monthly kilowatt-hour consumption, private charging stations on Edison service	110,000
Average kilowatt-hours per car per month in private charging stations	150
Average monthly bill for pleasure vehicle in private charging station on Edison service	$10.67
Percentage of total battery charging supplied by Commonwealth Edison Company	89%

Electric Vehicles in England.

The electric-vehicle movement is expected to receive a great impetus as a result of the war, especially for commercial service. The commandeering of automobiles on every hand in the early days of the war directed attention to the usefulness of electrics for short-distance service, and the taking over of many thousands of horses for army purposes, as well as the inevitable slaughtering of hosts of them, will create such a shortage of these animals that hundreds of traders who jogged along with horse-drawn carts will be obliged to make their too long deferred purchases of commercial motors.

The Electric Vehicle Committee is getting its forces into line for a well organized attack upon British conservatism. It has decided to publish a quarterly official journal in order to keep possible users of electric commercial vehicles in touch with the advantages and developments. This journal will be circulated gratis to town clerks, heads of electric supply undertakings, city and borough engineers, medical officers of health, superintendents of cleaning departments, boards of guardians, railway companies and others.

Unfortunately the committee is without funds and it is trying to secure the assistance of electric central stations, electrical manufacturers and electric-vehicle manufacturers.

Concerning the use of measuring instruments, the committee expresses the opinion that in the case of lead batteries a voltmeter and ammeter should be provided for controlling the charge and discharge. Where, however, it is not proposed to remove the battery from the vehicle for the purpose of charging and in cases where no constant attendance is provided during this operation, it is recommended that an ampere-hour meter should be provided in addition to the ammeter in order to show the condition of charge of the battery.

The committee considers that a mileage recorder is a necessary accessory for judging the condition of the battery in conjunction with the electrical instrument and for keeping accurate records of the working of the vehicle. The committee says that it has been informed that mounting this instrument on the dashboard has not proved satisfactory hitherto and the latest practice in America is mentioned, namely, the fixing of a strong steel pillar well in view of the driver and distinct from the dashboard.

Type "N" Charging Receptacle with iron vehicle mounting.

ANDERSON

CHARGING PLUGS AND RECEPTACLES

TYPE "N"

Included in the List of Approved Fittings

A thoroughly trustworthy and serviceable line, rapidly being adopted as standard by electric vehicle manufacturers and garage owners. Simplicity and a small number of parts distinguish the line; it is also practically fool-proof, provision being made to guard against the reversing of polarity, and, as in the Type "N" Ball and Socket Joint Charging Receptacle illustrated below, the carelessness of an operator who starts a vehicle before removing the plug from the receptacle cannot cause damage to plug, receptacle or cable.

Bulletin No. 29 fully describes the line. Write for a copy today.

Type "N" Charging Receptacle with ball and socket mounting for garages and charging stations. Plug will pull out without injury if vehicle is started before disconnecting.

Charging Plug Type "N" especially designed to prevent strain on current carrying parts

Albert & J. M. Anderson Mfg. Co.

Factory and Main Office: 289-293 A Street, Boston, Mass.

New York, 135 Broadway Chicago, 105 S. Dearborn St.
Philadelphia, 429 Real Estate Trust Building
London, 48 Milton Street

Electric Vehicle Manufacturers

Reach the central-station industry of the United States directly through the

Electrical Review and Western Electrician

The co-operation of the central-stations will do more to promote the use of electric vehicles than any other single agency.

Electric Vehicle Users

Keep abreast of every development in these equipments and in the design and manufacture of the electrical accessories used in the maintenance and operation of electric vehicles through the

Electrical Review and Western Electrician

Write today for full information relating to subscription and advertising rates.

Electrical Review and Western Electrician

608 South Dearborn Street CHICAGO

Electric Vehicle Association of America.

Fifth Annual Convention, Bellevue-Stratford Hotel, Philadelphia, Pa., October 19, 20 and 21.

PAPERS PROGRAM.

Progress of the Electric Vehicle, James H. McGraw, president, McGraw Publishing Company, New York.

Power-Wagon Operation in Central-Station Service, W. A. Manwaring, superintendent of transportation, Philadelphia Electric Company.

The Cost of Electric Vehicles, George H. Kelly, secretary and sales manager, Baker Motor Vehicle Company, Cleveland, O.

Electric-Vehicle Performance, Robert B. Grove, statistician, engineering department, United Electric Light and Power Company, New York.

A Practical Project to Secure Authentic Cost of Operating Commercial Vehicles, William P. Kennedy, consulting engineer, New York.

Electric Fire Apparatus, Chief George S. Walker, Philadelphia Fire Department, Philadelphia.

Educating the Public in the Field and Use of the Electric Vehicle, F. C. Henderschott, chairman of Committee on Education of Salesmen, National Electric Light Association.

Electric-Vehicle Charging, J. F. Lincoln, president Lincoln Electric Company, Cleveland, O.

Special Applications of Electric Trucks, F. Nelson Carle, advertising manager, General Vehicle Company, New York.

Effects from the Utilization of the Kinetic Energy of an Electric Vehicle, T. H. Schoepf, engineer, Westinghouse Electric & Manufacturing Company, Pittsburgh.

A Wider Dissemination of Electric-Vehicle Information, T. I. Jones, manager of Commercial Department, Edison Electric Illuminating Company of Brooklyn.

Calculations of Electric Motor Characteristics and Prediction of Vehicle Performance, A. A. Nims, engineer, Crocker-Wheeler Company, Ampere, N. J.

Symposium on the Electric Industrial Truck, contributed by the General Vehicle Company, New York; Elwell-Parker Electric Company, Cleveland; C. W. Hunt Company, New York; Automatic Transportation Company, Buffalo.

European Development of the Electric-Vehicle Industry, P. D. Wagoner, president, General Vehicle Company, New York.

The Design and Performance of Electric-Vehicle Motors, H. S. Baldwin, engineer, General Electric Company, West Lynn, Mass.

Constant-Potential Systems for Charging from Motor-Generators, H. P. Dodge, general manager, The Ohio Electric Car Company, Toledo, O.